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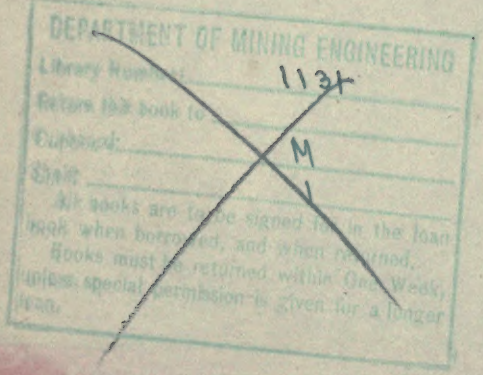
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# The Mining Magazine

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EXPLANATORY NOTE.—Items in italics are names of books reviewed; illustrated articles are devoted by Asterisks (*); the letters (*c.l.*) refer to notice of articles under the heading 'Current Literature'; the letters (*p.t.*) to abstracts appearing in 'Précis of Technology.


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# STATISTICS

### Stocks of Copper in England and the Continent.
Reported by Henry R. Merton & Co.

| | Oct. 31 Tons | Nov. 30. Tons | Dec 31 Tons |
|---|---|---|---|
| In England | 48,357 | 44,597 | 42,104 |
| In France | 5,704 | 5,485 | 5,254 |
| Afloat from Chile | 2,075 | 2,250 | 1,575 |
| Afloat from Australia | 5,900 | 6,350 | 8,350 |
| Total | 61,836 | 58,682 | 57,283 |
| In Rotterdam | 6,900 | 5,700 | 5,300 |
| In Hamburg (estimated) | 10,200 | 8,900 | 8,100 |

### American Copper Producers' Association.
In Tons of 2,240 lb.

| | Production. | Deliveries | | | Stocks at end of month |
|---|---|---|---|---|---|
| | | Domestic | Foreign | Total | |
| January 1911 | 51,650 | 18,785 | 23,753 | 42,538 | 63,591 |
| February | 49,030 | 22,553 | 20,139 | 42,692 | 69,929 |
| March | 58,273 | 29,500 | 26,375 | 55,875 | 72,325 |
| April | 52,716 | 23,396 | 27,736 | 51,132 | 73,909 |
| May | 56,679 | 28,814 | 27,669 | 56,483 | 74,105 |
| June | 55,605 | 27,525 | 31,902 | 59,427 | 70,283 |
| July | 50,075 | 25,438 | 33,429 | 58,867 | 61,491 |
| August | 56,024 | 26,757 | 31,185 | 57,942 | 59,573 |
| September | 51,602 | 25,587 | 22,689 | 48,276 | 62,899 |
| October | 52,792 | 28,602 | 26,832 | 55,425 | 60,267 |
| November | 49,945 | 30,375 | 29,932 | 60,307 | 49,905 |
| December | 54,865 | 29,459 | 35,374 | 64,833 | 39,937 |
| Total, 1911 | 639,258 | 316,791 | 337,009 | 653,800 | — |

### Production of Gold in the Transvaal.

| | Rand | Elsewhere | Total | Value |
|---|---|---|---|---|
| | Oz. | Oz. | Oz. | £ |
| Totals, 1910 | 7,228,588 | 305,532 | 7,534,120 | 32,002,912 |
| January 1911 | 625,862 | 25,201 | 651,027 | 2,765,386 |
| February | 585,683 | 24,965 | 610,828 | 2,594,634 |
| March | 649,247 | 26,818 | 676,065 | 2,871,740 |
| April | 638,421 | 29,293 | 667,714 | 2.836,267 |
| May | 658,196 | 27,755 | 685,951 | 2,913,734 |
| June | 657,023 | 27,544 | 684,567 | 2,913,734 |
| July | 679,881 | 29,377 | 709,258 | 3,012,738 |
| August | 682,405 | 31,002 | 713,407 | 3,030,360 |
| September | 669,773 | 30,852 | 700,625 | 2,976,065 |
| October | 677,923 | 30,721 | 708,644 | 3,010,130 |
| November | 291,466 | 28,267 | 719,729 | 3,057,213 |
| December | 680,782 | 29,126 | 709,908 | 3,057,213 |
| Totals, 1911 | 7,896,802 | 340,921 | 8,237,723 | 34,991,620 |

### Cost and Profit on the Rand.

| Month. | Tons | Yield per ton | Costs per ton | Profit per ton | Total profit |
|---|---|---|---|---|---|
| | | s. d. | s. d. | s. d. | £ |
| January 1911 | 1,865,232 | 26 6 | 17 11 | 10 1 | 930,059 |
| February | 1,712,198 | 28 0 | 18 3 | 10 3 | 874,612 |
| March | 1,960,678 | 28 6 | 17 11 | 9 9 | 949,415 |
| April | 1,926,583 | 27 7 | 17 6 | 10 1 | 971,858 |
| May | 2,002,926 | 27 7 | 17 10 | 9 7 | 956,823 |
| June | 1,986,559 | 27 6 | 17 11 | 9 8 | 960,381 |
| July | 2,095,220 | 27 2 | 17 10 | 9 4 | 969,687 |
| August | 2,107,809 | 26 8 | 17 9 | 8 11 | 967,457 |
| September | 2,037,329 | 27 4 | 18 1 | 9 4 | 952,665 |
| October | 2,083,900 | 27 0 | 18 0 | 9 1 | 948,278 |
| November | 2,089,387 | 27 6 | 18 3 | 9 3 | 965,729 |

### Natives Employed in the Transvaal Mines.

| | Gold mines | Coal mines | Diamond mines | Total |
|---|---|---|---|---|
| January 31 | 183,268 | 8,357 | 9,991 | 201,616 |
| February 28 | 189,434 | 8,513 | 9,814 | 207,761 |
| March 31 | 193,457 | 8,493 | 10,061 | 212,011 |
| April 30 | 194,328 | 8,511 | 10,272 | 213,111 |
| May 31 | 190,392 | 8,379 | 10,425 | 209,196 |
| June 30 | 186,940 | 8,212 | 10,597 | 205,749 |
| July 31 | 181,582 | 8,122 | 11,054 | 200,758 |
| August 31 | 179,810 | 8,182 | 11,292 | 199,284 |
| September 30 | 179,619 | 8,045 | 11,475 | 199,139 |
| October 31 | 179,194 | 8,078 | 11,319 | 198,591 |
| November | 176,736 | 8,043 | 10,071 | 194,850 |
| December | 178,282 | 8,053 | 8,914 | 195,249 |

### Gold Output of India.

| Year 1909 | Year 1910 | Dec. 1911 | 1911 |
|---|---|---|---|
| £2,083,901 | £2,104,858 | £196,760 | £2,150,050 |

### Production of Gold in Rhodesia.

| Month. | 1908 | 1909 | 1910 | 1911 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| January | 199,388 | 204,666 | 227,511 | 207,903 |
| February | 191,635 | 192,497 | 203,888 | 203.055 |
| March | 200,615 | 202,157 | 228,385 | 231,947 |
| April | 212,935 | 222,700 | 228,213 | 221,296 |
| May | 223,867 | 225,032 | 224,888 | 211,413 |
| June | 224,920 | 217,600 | 214,709 | 215,347 |
| July | 228,151 | 225,234 | 195,233 | 237,517 |
| August | 230,792 | 228,296 | 191,423 | 243,712 |
| September | 204,262 | 213,249 | 178,950 | 225,777 |
| October | 205,466 | 222,653 | 234,928 | 218,862 |
| November | 196,668 | 236,307 | 240,573 | 214,040 |
| December | 217,316 | 233,397 | 199,500 | — |
| Totals | 2,526,007 | 2,623,788 | 2,568,201 | — |

### Production of Gold in West Africa.

| Month. | 1909 | | 1910 | | 1911 | |
|---|---|---|---|---|---|---|
| | Oz. | Value | Oz. | Value | Oz. | Value |
| | | £ | | £ | | £ |
| January | 22,817 | 91,112 | 17,357 | 70,699 | 15,903 | 66,107 |
| February | 21,403 | 86,210 | 16,976 | 68,469 | 15,179 | 63,081 |
| March | 23,186 | 93,556 | 17,627 | 71,954 | 16,387 | 67,673 |
| April | 21,491 | 88,071 | 16,363 | 67,069 | 17,237 | 70,880 |
| May | 25,104 | 100,056 | 16,590 | 68,355 | 24,427 | 96,409 |
| June | 17,340 | 70,561 | 17,194 | 70,988 | 22,555 | 92,174 |
| July | 17,331 | 70,523 | 15,564 | 58,551 | 22,510 | 91,955 |
| August | 17,766 | 71,614 | 13,921 | 57,713 | 25,385 | 103,753 |
| September | 18,125 | 72,963 | 11,497 | 47,746 | 26,717 | 109,039 |
| October | 15,957 | 65,813 | 13,341 | 55,046 | 26,826 | 109,503 |
| November | 17,882 | 73,824 | 14,021 | 57,658 | 24,289 | 99,299 |
| December | 17,570 | 71,332 | 15,042 | 61,737 | — | — |
| | 235,972 | 955,635 | 185,493 | 755,985 | — | — |

### Production of Gold in Western Australia.

| Month. | Export oz. | Mint oz. | Total oz. | Total value |
|---|---|---|---|---|
| | | | | £ |
| Total, 1910 | 363,496 | 1,209,856 | 1,573,352 | 6,682,042 |
| December 1911 | 3,269 | 113,089 | 116,358 | 494,510 |
| Total. 1911 | 160,021 | 1,210,447 | 1,370,468 | 5,823,522 |

### Other Australasian Gold Production.

| | 1909 | 1910 | December 1911 | 1911 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Queensland | 1,916,468 | 1,840,337 | 144,280 | 1,623,390 |
| New South Wales | 869,546 | 803,727 | 40,851* | 689,220* |
| New Zealand | 2,006,910 | 1,896,322 | 129,922 | 1,808,049 |
| Victoria | 2,897,340 | 2,422,700 | 181,385* | 1,951,492* |

* November figures only.

### Sale of Tin Concentrate at Redruth Ticketings.

| | Tons | Value | Average |
|---|---|---|---|
| September 4, 1911 | 220 | £25,262 | £114 16 8 |
| September 18, „ | 249¾ | £27,170 | £108 15 9 |
| October 2, „ | 224¾ | £25,221 | £112 4 4 |
| October 16, „ | 251 | £28,342 | £112 19 1 |
| October 30, „ | 235½ | £27,176 | £115 8 0 |
| November 13, „ | 248¼ | £28,274 | £113 17 11 |
| November 27, „ | 232¼ | £27,385 | £117 18 3 |
| December 11, „ | 276½ | £31,346 | £113 7 5 |
| December 27, „ | 243½ | £28,686 | £117 14 6 |
| Year 1911 | 6151¼ | £702,599 | £114 4 5 |

### Exports of Tin and Ore from Straits and Bolivia.
Reported by A. Strauss & Co.

| | Nov. 1911 tons | Dec. 1911 tons | 1911 tons |
|---|---|---|---|
| Metal from Straits to Europe and America | 5,045 | 5,765 | 55,135 |
| Metallic Content from Bolivia to Europe | 1,363 | 1,920 | 22,577 |

# REVIEW OF MINING

INTRODUCTORY.—Diplomatic anxiety has been allayed and wars have receded into the background of public interest, but the markets are dull. The new year has not started with any marked improvement, for it is still burdened with the legacy of disappointment left by 1911. The trade statistics for 1911 exhibit a splendid growth of business, and money is accumulating, but mining speculation is somnolent. The East Rand fiasco will occupy public attention until it has been thoroughly ventilated at the shareholders meeting. That is on the 18th instant. In the meantime it is stated that Sir George Farrar personally is to receive support from the Central Mining group, and will therefore remain chairman of the company. Apart from personalities, we hope an organized effort will be made to insist on company meetings being held in London, soas to give European shareholders some voice in shaping the policy under which their own property is operated. We note with pleasure that Messrs. Lewis & Marks have set a good example by announcing their intention to hold annual meetings of all their companies in London henceforth. The Rhodesian market is suffering from lack of public confidence, due to strange performances on the part of the controlling speculators. In West Africa all is quiet, save the boom in Nigerian tin shares, which has now been overdone. North American mining is gaining from the improved copper position. South American mines are engaging more attention. There are signs of renewed interest in Mexican business. Labour conditions are bad in Australasia.

The year-end holidays all over the world have caused interruption to work and temporary curtailment of output. In some countries religious festivities have interfered with regular operations ; in others, bibulous.

TRANSVAAL.—The November statistics of gold production exhibit another record, being 6322 ounces more than the previous highest, in August. The gain is due to the Modderfontein B, which has joined the list of productive mines. The 719,729 oz. produced is worth £3,057,213. For December the figures are 709,908 oz., valued at £3,015,499 so that the total for 1911 reached £34,991,620 as against £31,995,266 in 1910. The analysis of the November returns shows an increase of 6000 tons in the amount of ore crushed, due mainly to the Modderfontein B. Despite the bigger tonnage, the average cost is 3d. per ton higher, at 18s. 3d., but the yield is 6d. higher, at 27s. 6d., so that the total 'profit' for the month is £965,729 from all the mines of the Witwatersrand. The labour statistics show that at the end of the year 1911 the number of natives employed on the gold mines was 178,282, as against 176,736 at the end of November. This is a gain of 1546, as against a gain of 575 during the corresponding month of 1910. The total at the end of December 1910 was 178,602, so that there is a net loss of 320 during the 12 months. Thus all the efforts to stimulate recruiting and the hopes of an enlarged labour supply have proved disappointing. The proposal to restrict recruiting for the mines to the native reserves has tended further to emphasize the seriousness of labour conditions, and we are not surprised that the President of the Chamber of Mines should have stated that such a restriction would entail a loss of 7000 workers, "a fact which could but be viewed with alarm."

Dividends from Rand mining companies are £700,000 less for 1911, as compared with 1910, in which year the total was £8,876,083, as against £9,310,751 in 1909. Among the mines that show an increase of dividends for

1911 are City & Suburban, New Modderfontein, New Primrose, Robinson Deep, Wolhuter, and Transvaal Gold Mining Estates.

The Brakpan, one of the bright spots on the Rand horizon, is the unexpected cause of disappointment, the directors being compelled to confess that the estimate of capital expenditure was too low by about £150,000, which must now be taken out of profits accruing. Thus the £110,000 already earned is not available for dividends, but the earnings beginning with the new year will be set aside for that essential purpose. Apart from this financial miscalculation, the Brakpan has started well and ought to do even better when the stopes have been so extended as to provide a surplus of working faces, so that the output can be averaged to that of the profitable ore in the mine. The milling of dump rock, accumulated during the period of development, is another factor calculated to reduce the yield, but it is unavoidable at a preliminary stage when there is a surplus of crushing capacity over the output of the stopes.

Mr. W. T. Anderson, formerly manager of the Glen Deep and then assistant to the chief engineer (Mr. George E. Webber) of the Rand Mines, has been appointed general manager of the East Rand Proprietary, in association with Mr. H. Ross Skinner, previously appointed advisory engineer. Mr. Anderson is highly regarded by technical men and his appointment has been well received.

City Deep shares fell at the end of the year on the resignation of the manager and rumours of the mill ceasing productive operations pending re-building. These rumours were officially denied. The breakdown of the pump on the bottom level hindered the hoisting of ore for a few days and caused further uneasiness.

The encouraging development of the Balmoral portion of the Ginsberg property serves as a reminder to those who were shareholders in the Balmoral before it was absorbed into the larger scheme in exchange for 35,000 Ginsberg shares. The incident affords further evidence of the helplessness of European shareholders so long as the control is placed at Johannesburg, instead of London.

RHODESIA. — The November statistics show a further decrease in gold production, being 1143 ounces less than October, and 2784 less than September. The November output was worth £214,040, as against £243,712 in August. The decrease is due to small changes at a number of mines and does not reflect any pronounced decline at any one property.

Rhodesian dividends in 1911 amounted to £598,735 as against £477,750 in 1910. Among the contributors are the Wankie colliery and the Rhodesia chrome mine.

The influence of public opinion is shown by the voluntary withdrawal, by the board of directors of the Amalgamated Properties of Rhodesia, of the provision conferring upon the directors the power to increase the capital of the company without the consent of the shareholders. A resolution to this effect is to be officially submitted at the general meeting on January 25. At that meeting Dr. Hans Sauer will make an explanation. It is urgently required.

Shamva shares have been weak owing to realizations on the part of well informed speculators. Even some good news concerning the third adit did not raise the quotation. Irresponsible scribblers write concerning this deposit as if it were a lode likely to be persistent to great depth; it is an irregular deposit of interlacing quartz stringers in a shear-zone traversing a quartzitic sandstone. Such a formation has larger dimensions laterally than vertically. The Shamva is a valuable mine, but, like others in Rhodesia, it has been the victim of robust optimism.

In our November issue we noted with approval the formation by the British South Africa company of a subsidiary intended to

assist in the more rapid development of Rhodesian ore deposits. It is now announced that another institution has been founded under the same auspices, this time for the purpose of helping settlers on the land. This is the Rhodesia Land Bank, and among the directors are Sir Lewis Michell and Mr. Henry Birchenough. If this bank is worked on strictly commercial lines, it should prove of great value in the permanent settlement of the country.

We refer elsewhere to the proposed amalgamation of the Rhodesia Exploration and Gold Fields Development companies. Soon after these pages appear in print, Dr. Hans Sauer will be giving on explanation to the shareholders in the Amalgamated Properties. We note that the celebrated googly bowler, Mr. R. O. Schwarz, has followed Mr. A. J. Sharwood, another of Sir Abe Bailey's nominees, into retirement. Even the sinuous curve of the googly is a straight line compared to the devious ways of Rhodesian finance. For obvious reasons the two directors who refuse to play the part of inglorious dummies are unable to disclose the reasons for their resignation, but the incident is not wasted.

The Surprise has given another contribution to *opera bouffe* mining. The cross-cut at 620 feet that was to intercept the vein has found nothing and it is acknowledged that the outlook is "most discouraging." During 1910 the shares were hoisted from a few shillings to £4 per share; they are now over-valued at 15s. The sooner the Surprise is forgotten, the better for the repute of Rhodesian mining.

At last a cablegram from Mr. H. E. Jones explains the uneasiness in regard to the Eldorado. It appears that a dike has "disturbed the parallel reef on the 8th level," and that the ore beyond it assays only 8 dwt. A winze going down to the 9th level is in good ore, but it is not stated whether this is beyond the dike or not. The information is defective. Mr. Jones concludes by saying that "the condition of the mine is quite satisfactory." We would like to have his real opinion; in which we would have confidence. When a vein is crossed by a dike it is usually enriched on one side, but not the other.

WEST AFRICA.—The November gold output was 24,289 oz., valued at £99,299. This is a decrease of £10,204 compared with October, but it is £42,000 better than the corresponding month of 1910. Little news is forthcoming. The Ashanti Goldfields records the usual production, worth £40,320, of which £18,105 is profit. We note with pleasure that development and other expenses are now deducted, so that the estimated monthly profit "approximates to the rate of distributable profit-earning." The Ancobra Dredging Co. recovered 654 oz. gold in November, making the half-year's total production £13,583, obtained by 3 dredges, as compared with £9494 by 4 dredges during the previous half-year. The decrease is due wholly to the Prestea, whose output was worth £12,861, as against £20,132 in October.

Developments in the Taquah and Abosso mines are excellent. The north shaft of the Taquah is now 231 feet deep and in ore assaying 23 dwt. per ton for 36 inches wide. The two rises above the 8th level are both in 20 dwt. ore, averaging 4 to 4½ feet.

We hear good reports of the Abbontiakoon, which is getting ready for the starting of the mill in March. The reserve of ore is stated to be 250,000 tons averaging 40s. per ton. The report of the Himan Concessions states that the Anfargah mines are to be developed forthwith, but work has not been started at the Bogosu.

We note an interesting letter from Mr. Oliver Wethered, explaining that the labour shortage in Northern Nigeria during December was due largely to the employment of men on the construction of the Bauchi railway. This is not grudged, as the railway will give direct transport to Kano and other im-

portant districts. Mr. Wethered writes cheerfully concerning the new discoveries, which include deep river-channels and lode deposits.

AUSTRALASIA.—At Kalgoorlie the engineers' union has been causing trouble to the mine managers by demanding 1½ wages for overtime and double wages for work on Sundays and other holidays, besides a higher rate of pay, 8 hours per diem and 48 hours per week, with preference to members of the union. The men refused at first to submit the matter to the Arbitration Court, but the Chamber of Mines took a strong stand, and successfully. A general shut-down was prevented. The fitters, turners, and smiths who were making trouble obtained no sympathy from the other unions or from the general community. Here were 150 men trying to hold up an industry employing 6000 workers and supporting 31,000 people. The Associated Northern has bought the Gimlet South Extended for £22,000, the mill-tests having confirmed the sampling. The Government is to establish a water-supply within six months. The manager, Mr. G. M. Roberts, formerly at the Associated, expects to treat a big tonnage, up to 1000 tons monthly. This ore is low-grade, but it can be worked cheaply. This deal will stimulate operations in the Ora Banda district. Good assays are being obtained from the lode in the cross-cut at 2800 ft. in the Golden Horse-Shoe. The ore yields 33 dwt. for a width of 6 ft., showing both free gold and the telluride. This is better than a bore-hole sample.

As we have previously recorded, the discovery of a new orebody at the British mine is the most important event of the past year at Broken Hill, from the mining point of view. The Australian public in general and shareholders in particular are inclined to resent the scarcity of information obtainable locally, due to the headquarters of the company being in London. To this fact may be attributed the avalanche of rumours emanating from Adelaide and Melbourne to the effect that the importance of the discovery has been greatly exaggerated. To counteract these rumours the local board called a meeting at Adelaide, at which Mr. W. H. Woodhead, the manager, gave full information. The board also asked Mr. George C. Klug to make an examination of the mine and give his opinion on the new discovery. His preliminary report has just been published and though he is inclined to be cautious, his general conclusions confirm those of Mr. Woodhead. The report appears in some quarters to be regarded as disappointing; on the contrary we consider it decidedly favourable. The ore averages better than in the North or the South mines, which make £1 per ton profit, including the zinc. Thus the 1,000,000 tons should mean a million sterling.

The temporary cessation of milling by the Zinc Corporation need not excite suspicion. It appears that the contract called for 95,000 tons of concentrate; this was produced, and about 4000 tons more; not having a market for the surplus, it was necessary to abate metallurgical energy.

The labour troubles at Mount Lyell have crippled operations during the past month. Even now, despite some sort of settlement, the number of men at work is insufficient to run all the blast-furnaces. Offensive conduct is alleged against some of the labour leaders, and the earlier history of this strike fully warrants the belief that they are in an ugly mood, hindering a satisfactory settlement of claims. We note that the men employed on a Government reservoir in South Australia struck because the manager stopped their afternoon tea, the custom having developed into a serious interference with regular work. This gives eloquent testimony in regard to labour conditions in Australasia.

The manager of the Talisman has been sending the best of news concerning deeper developments, in the No. 12 winze below the 13th level. These ought to improve the ore

reserve, which in June stood at 52,000 tons of £6 ore, which can be mined and milled for about £2 per ton, so that the profit assured is placed at £208,000. However, the 345,000 shares issued are quoted at £2½, so that the mine is valued at £862,500. This is a reckless appraisal, for it is four times the profit assured. During the last fiscal year the dividends amounted to 6s. 6d. per share, which is 13% on the market quotation. The mine is one of great promise, but it does not warrant one-half its present valuation. To return 10% on £862,000, and in addition sufficient to amortize the capital at the end of 10 years on a 4% basis, the yearly receipts must be £157,996. Thus on ore yielding £6 per ton and a profit of £4, the annual output must be £217,000 from 39,500 tons. During the 10 years the mine must yield 395,000 tons having an assay-value of £2,170,000, or ten times that now assured. These figures should give pause even to the most reckless speculator.

INDIA.—At the North Anantapur, the No. 5 shaft has been sunk to 265 ft. and has intersected the lode, which at this point averages 1 oz. gold per ton. At a point below this, in a cross-cut driven from the North shaft at the 450-ft. level, the lode has been proved to contain 1½ oz. per ton over 5 ft. 6 in. These two discoveries are of considerable importance to this goldfield. No news of special interest comes from the Kolar district, except that small increases in output at several of the mines have brought the aggregate output of gold in India during 1911 to £2,150,050, the highest figure yet recorded.

UNITED STATES. Our correspondents at New York and San Francisco send interesting news. It is announced that two of the most promising 'disseminated copper' mines —the Inspiration and Live Oak—have been united to form the Inspiration Consolidated Copper Co., with Messrs. W. B. Thompson and W. D. Thornton as president and vice-president. Engineers estimate that the Inspiration has 30,000,000 tons of 1·95% copper ore, and the Live Oak 15,000,000 tons of 2·11% ore. Production is to start in 18 months and is ultimately to be at the rate of 65,000,000 lb. per annum, at a cost of not over 8½ cents per pound. A stampede is reported from Reno, Nevada, caused by the reported discovery of rich ore in the old

*THE USE OF BY-WATER IN HYDRAULIC MINING.*

Wedekind mine. Edward Arkell, an old prospector, is the hero of this rush. The story is probably apocryphal.

The copper statistics are again cheerful, indicating a further decrease in stocks. Our New York correspondent offers useful comment on the metal market.

CANADA.—It is announced that W. W. Mein has become advisory engineer to the Dome Mines at Porcupine. On the Pearl Lake a diamond-drill has penetrated through low-grade ore from 1155 to 1218 ft. in vertical depth. The lode is a schist traversed by quartz stringers. The manager is George W. Thomson, a graduate from Otago, New Zealand. The McIntyre, which adjoins, has struck a new vein 30 ft. wide at a depth of 200 feet, in a cross-cut. The ore is said to be worth $19 per ton, but this includes an exceptionally rich assay. A mill is being erected. Speaking generally, much activity is shown at the principal mines at Porcupine, and significant results ought to be published during the early part of the year.

The silver output of Cobalt for 1911 is estimated to be 31,500,000 ounces, or 1,500,000 more than 1910. Two of the mines at Gowganda are now steadily productive.

MEXICO.—On another page we summarize the recommendations made by Mr. R. T. Bayliss, the chairman of the El Oro Mining and Railway Company. These were sent from the mine, where Mr. Bayliss has been making one of his periodical visits of inspection. The report is a frank and businesslike document, giving the essential facts in a manner worthy of the cordial approbation of those who wish mining to be a legitimate business.

At the end of September it was announced that the San Carlos vein in the Esperanza was opening up well. It had been cut on the 11th level in July. Since then a drift has been extended 300 feet in ore, 7 ft. wide and 2½ oz. gold per ton. The rise in the quotation, however, has been helped by the transfer of a block of shares that had been a menace to the market.

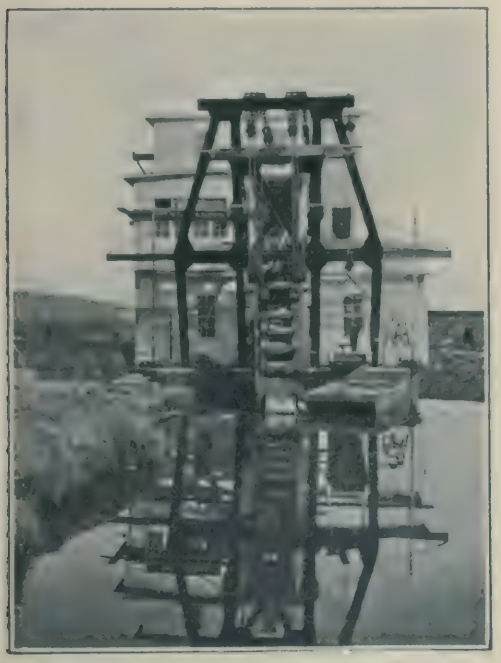
We hear good news concerning the Tampico oilfield on the coast of the Gulf of Mexico. The great oil geyser or 'gusher,' known as the Juan Casiano No. 7 well of the Huasteca Petroleum Co., has now established a record of over 12,000,000 bbl. without any sign of water or diminution of flow. It began to emit oil on September 11, 1910, and has averaged about 25,000 bbl. with a maximum of 40,000 barrels per diem. Apart from this well, others have 'come in' of such a capacity as to indicate that this district may be shortly developed so as to yield a production equal to 10% of the total oil output of the world. The Mexican Petroleum Co., which is controlled by Messrs. E. L. Doheny and H. G. Wiley, is building a railway for the transport of supplies. Drilling has stopped, there being sufficient wells 'capped' already. It is now a question of regulated production. On the Panuco river the American subsidiary of the Gold Fields of South Africa is drilling, on the advice, it is understood, of Mr. Hays Hammond.

The La Fé Mining Co., recently organized, is interesting as indicating a further incursion of South African capital into Mexico. For A. Goerz & Co. are the sponsors, and with them in this case is associated Mr. Sidney H. Farrar. The property is near Zacatecas and covers 3000 feet of the celebrated Cantera vein. The workings are 250 feet deep and expose an orebody 23 ft. wide and 650 ft. long, averaging 39s. per ton. This mine is still in the oxidized zone.

RUSSIA. — The new dredge of the Orsk Goldfields has made a start on the Kolchan claims. It was only a test at the very end of the season, but it may be considered satisfactory. Work continued from October 25 to December 5. It is reported that 47,000 cubic yards were dug in 433 hours for a yield of £2700 and an operating profit of £1520.

The estimated yield is 14d. and the cost 6d. per yard. The stacker-scow on the Pokrovsky claims treated 88,500 cu. yd. for a yield of £24,200 at an operating cost of £3370 or 9d. per yard. This was for the season, which lasted 158 days. None of the costs quoted include administration expenses, which are heavy.

The finances of the Kyshtim Corporation have been placed on a more satisfactory footing by the redemption of certain government



*The New Dredge of the Orsk Goldfields.*

and bank mortgages that encumbered the business of the Russian company, the Kyshtim Mining Works. These debts have been redeemed by means of money raised by the issue of £250,000 new debentures by the Corporation. When these debentures were issued, 260,000 new shares were also created, so that the holders of these or previous debentures may exchange into shares as desired. By this re-organization of capital a considerable saving of charges will be effected. Mr. R. Gilman Brown, the engineer, reports that the ore reserves at all three mines have been substantially increased during the last half-year, and that at the time of his visit in November they stood at 1,800,000 tons, averaging 3·1%. The converter plant is now in good order, and the remodelled electrolytic refinery should be in regular work in a month or two. The production of refined copper for 1912 is estimated at 6400 tons. Mr. Gilman Brown estimates the cost of producing copper at £34 per ton, not including the general expenses of administering the estate. The report on the geology of the Kyshtim estate, by Mr. H. W. Turner, is expected at any time, and it should materially help in the development of so great a tract of country, measuring nearly 2000 square miles.

It is stated that Mr. J. M. Bell, the geologist, takes a favourable view of the persistence of the Spassky orebody.

TIN.—The report of the manager of the Tronoh indicates a decided discord with the acting manager. Mr. Harry D. Griffiths, on his return to the mines from England, found that the bursting of a dam, unusually heavy rains, and his substitute's performances had created a complex situation. However, he has sent a reassuring report, outlining the maintenance of an output of 4500 piculs per month for at least 18 months, yielding a profit (excluding capital expenditure on plant) of £12,000 monthly. The mine was to be in normal working order by the middle of December.

Among tin mines the Tongkah Harbour Tin Dredging Co. has been conspicuous in the past as the subject of acute controversy. but now has become more pleasantly known by its dividends. During the year, 2,217,343 cu. yd. of dredging was done for a yield of 1143 tons of tinstone, this being an average of 1·15 lb. or 12·7d. per yard, as against a dredging cost of 3·5d. per cu. yd. Other charges amounted to nearly a penny (0·96d.) more per yard. The output realized £117,487, leaving an operating profit of £76,139. During the year 3s. per share, or 15%, was paid in dividend. Five dredges are at work.

# EDITORIAL

INSUFFICIENCY of labour was a dominant factor in mining, as in other industries, during 1911. Of the total cost of mining operations 60% is recorded on the workmen's pay-roll. The invention of labour-saving machinery has economized the major expense of mining, but it has failed to keep pace with the demand for human muscle.

ENOUGH has been said concerning the East Rand for the present. We await further developments. In the meantime we may compliment Sir George Farrar on proving that he is true to his war record. He has faced the music, and for that reason we hope he may be able to give a better account of his stewardship than the known facts would lead us to expect.

A STORY is going the round of an assayer in Northern Nigeria who, on being given a sample of tin ore, reported that he had crushed it and passed it through a sieve, the coarse assaying 54% tin and the fine 55%, so that he was able to certify the total metal contents as 99%! Whereupon Mr. H. L. Sulman suggested that it is a case of chemical overlap. It is also an example of analytical paresis.

THE ANNUAL DINNER of the Institution of Mining and Metallurgy was an agreeable function in every way. Both the president and the president-elect did their duty nobly, delivering speeches admirably adapted to the occasion. Sir Alfred Keogh, rector of the Imperial College of Science and Technology, was well fitted to do justice to the toast of the evening and he proposed it in felicitous terms, followed by suggestive observations, among which we noted with keen pleasure an expression of approving interest in the campaign for standardization and precision of terms.

OUR COMPLIMENTS to the Johannesburg correspondent of the *Financial Times*. We do not know who he is, but we know good journalism when we see it. During the last six months he has shown splendid enterprise in obtaining advance information, and he has added greatly to the value of it by his own outspoken comment. Mining has nothing but good to gain from such journalism. The hired scribbler has ceased to be interesting.

FINANCIERS may well ask to be spared the unnecessary flattery of their newspaper friends. Thus Mr. Louis Reyersbach, as chairman of the Appantoo Consolidated, felt justified "in expressing the hope that the geographical position warrants the expectation of a payable proposition being developed." Whereupon the scribe in the *Financial News* says that "coming from such an authority as Mr. Louis Reyersbach the words have more than ordinary significance." This is flapdoodle. Coming from anyone these words have no significance, and merely express the necessity for saying something without telling anything.

A DRAUGHTSMAN is wanted, according to an advertisement in *The Mining Journal*; the man required must have had a technical training, with experience of mine plans, and underground work as well. He is to receive £120 per annum. The noble generosity of the advertiser reminds us of the gentleman who wanted a man to act as valet, butler and coachman, and to do the gardening between times, as well as a few other things, for 25s. per week. He got a reply from a

man who said that he could fulfil all the requirements but, being averse to idleness, he would like to know if there was any clay in the gentleman's garden, so that he could make bricks when not otherwise employed.

CALIFORNIANS will be pleased to learn that Mr. William H. Storms has been appointed State Mineralogist of California, succeeding an incumbent who has incumbered an honourable post far too long. The political corruption associated with the name of the Southern Pacific Railway has for many years robbed the office of State Mineralogist of any scientific or industrial importance, and for this reason alone the new appointment by Governor Johnson would be received with pleasure. Most fortunately the appointment has been given to a man known long and honourably for his intelligent understanding of the natural resources of the State. If Mr. Storms is supported, as we understand he will be, by trustees thoroughly in touch with the mining industry of California, he will, we feel sure, be able to give an administration of practical usefulness to a region as rich in minerals below ground as it is blessed with beauty above ground.

AT THE LAST regular meeting of the Institution, an interesting paper on emerald mining was presented, and in his contribution to the discussion an honoured member criticized the use of 'carboniferous' in describing a carbonaceous rock of Cretaceous age; he also demurred to the use of 'bedrock' where 'foot-wall' or 'wall-rock' was evidently required. These suggestions awakened our sympathetic interest, and all the more seeing that they emanated from a member of the Publications Committee. We are wondering whether it is not within the amiable duties of that committee to protect an author from obvious blunders and to save him and the Institution from being held up to ridicule, a task at present by no means difficult in matters of this particular kind. Errors undetected and uncorrected in the early stages of publication have a disagreeable way of persisting even into those dignified volumes that transmit the Institution's wisdom to posterity.

WE have been favoured with a report of the proceedings of the American Mining Congress in its fourteenth annual session at Chicago on October 24 and following days. The 400 pages that record the sayings of those assembled contain much that is interesting, and the most interesting to us is an address by Mr. Falcon Joslin, of Fairbanks, on 'The Alaskan Coal Situation.' This has the authentic ring of a live man's experience with mining laws that appear to exhibit most of the faults and few of the virtues of governmental control of industry. To make matters worse, even such regulations as exist have been subject to abrogation by the executive order of the President, at Washington, introducing an uncertainty of tenure that is paralysing the mineral exploration on a far frontier. The coal mining industry of Alaska has been smothered between graft and sentimentalism. We extend greetings to Mr. Joslin and other valued friends in Alaska, and wish them success in their effort to obtain an equitable settlement of wrongs that affect not only them but the whole of an important mining region.

THREE important companies have had to confess that their capital requirements have proved so much larger than was anticipated as to necessitate the passing of expected dividends. We have referred to the Brakpan elsewhere. The Langlaagte Estate has reduced its dividend for 1911 from 30% to 15%, because £60,000 had to be spent on the equipment of Block B and on a filter-press plant. The Randfontein Estates and Randfontein Central companies issue a statement explaining that the £2,000,000 of debentures realized

only £1,420,000, after paying off an old loan, the consolidation expenses, debenture commission and interest. The total additional capital required has proved to be £2,077,000, leaving a deficit of £657,000. The profit for 1911 was £860,000, and it has been decided to devote most of this to liquidation of the deficit. While all three companies speak of the 'postponement' of dividends, it is manifest that it is more than this, for it means that a definite portion of the gold in the mine has had to be set aside for unexpected equipment and other expenses, and that just so much of the mine's resources have been diverted from their basic purpose, namely, of enriching the bank account of shareholders. *Le temps fait le chanson;* others may place the accent differently, but our view is as stated.

THIS YEAR'S balloting list for election to the council of the Institution of Mining and Metallurgy exhibits a progressive growth in the idea of rotation in tenure of office. Thirty official nominations are made, and from these 24 names are to be selected. Three of those nominated have recently received interim election to fill vacancies, namely, Sir Thomas Holland, Messrs. Humphrey M. Morgans, and Stephen Vivian; on the other hand Messrs. T. Kirke Rose, C. M. Rolker, and William Rich retire. Moreover, the election to the presidency of Mr. Edward Hooper and the resignation as vice-president of Mr. R. T. Bayliss has made room for the two new vice-presidents, who are Messrs. John H. Cordner-James and Hugh F. Marriott. Again, the transfer of Messrs. R. A. Varden and Arthur Wilkinson to the list of 'corresponding' members of council, in consequence of their sojourn abroad, created two more vacancies, filled by Messrs. H. C. Taylor and E. W. Janson. Mr. Richard Pearce also, we note with regret, is among the names absent, he having retired for personal reasons. Thus eight changes occur in the personnel of the Council as it was immediately after the last annual election. To fill these vacancies and to afford some selection to members voting, it will be seen that 10 new names are submitted. Even if only one-half of these are elected the Council will have undergone quite enough change to emphasize the idea of rotation. That those now in the Council desire to see good men taking their places, in turn, and for a time, is shown by the excellent selection of nominees for candidature. They include Messrs. John F. Allan, R. Gilman Brown, Thomas Girtin, André P. Griffiths, J. A. L. Henderson, Fearnside Irvine, Richard D. Oldham, Arthur E. Pettit, William Selkirk, and W. F. A. Thomae. Such a list should be highly gratifying to the membership of the Institution as indicating what reserves of strength are readily available for its administration. Obviously the policy adopted by the governing body exhibits a generous and enlightened spirit, affording the best of promise for the continued prosperity and usefulness of the Institution.

REFERRING to the Government Commission of inquiry into the East Rand affair, we stated, in our October issue, that the Midas Deep inquiry proved a fiasco, because "ore outside that Company's boundaries and actually within an unproclaimed area was included in the supposititious reserve." This information came to us from a reliable mining engineer. We are now in receipt of a letter from the office of the High Commissioner to the Union of South Africa, quoting the Secretary of the Department of Mines, who says that our statement in inaccurate. He adds: "It is possible that a misapprehension has arisen from the fact that a portion of the area worked by the Midas Deep was held under mijnpacht title, which, as you are aware, was technically not 'proclaimed' land within the meaning of the Gold Law." What he suggests as possible, we

accept as probable, and thank our critic for the opportunity to make a correction. It is also pointed out that the Government Commission to inquire into the East Rand fiasco was withdrawn, but the members of it were re-appointed as examiners under the Company Act. This we recorded two months ago. A third note of protest is sounded against our suggestion that "so many of the mining magnates are in politics in South Africa that it would be difficult to select a commission that would command confidence." That is a matter of opinion; we correct errors of fact, with pleasure, but we are reluctant to amend our opinions on insufficient evidence.

BLOEMHOF is the scene of a diamond excitement. This village on the Vaal river, and upon the main line between Johannesburg and Kimberley, on the Western border of the Transvaal, came to the front late in 1910, when the chance discovery of some diamonds attracted wandering diggers. According to an excellent account in *The Times*, this sparsely populated pastoral area became a scene of energetic prospecting. Under the grass of the arid veldt there is an overburden about a foot thick, overlying the gravel deposit, itself from 12 to 36 inches deep, in which the diamonds are found. Although close to the Vaal, the deposit is not of fluviatile origin. Among the earliest diggers were the sons of the Dutch farmer owning Mooifontein, which is 17 miles north of the river. Noticing that the gravel containing the diamonds resembled that on their own farm they returned home and tested their own ground. They found diamonds, and in September 1911 a part of the farm-land was proclaimed an alluvial digging. At the end of three months Mooifontein became a mining camp with 6000 people, black and white, all feverishly searching for gems. Further portions of the farm were thrown open, but now the patriarchal owner has protested, in a characteristic Boer spirit, because the new-comers have brought cattle and sheep that forage over his veldt. He is receiving £600 per month as his share of licence moneys, but this he considers of small account against the injury to his flocks and herds. The winning of diamonds from this shallow deposit is proceeding at the rate of £30,000 per month, and it would be more if water and labour were not so scarce. Many of the diggers are Boers, who have trekked thither with their families, They work in a leisurely way. Conditions are unpleasant owing to the dust rising from the sieving machines in which the gravel is treated before washing. Sanitary precautions are at a discount, and it is a marvel that no epidemic has broken out among the mixed mob of workers. Diamonds have been found over an extensive area, notably on a farm named London, fully 20 miles north of Bloemhof. At London a good supply of water is available and when the farm is proclaimed a big rush will ensue. The London diamonds are worth £6 and the Mooifontein £4 per carat. Thus the quality is inferior to the river stones found at Klipdam, but blanks are few and most of the diggers are making a living, while a few are winning a fortune. It is likely that these diggings will attract the roving population of South Africa for many years to come, and they will incite systematic search for the 'pipes' from which the diamonds must have been derived.

### Looking Backward.

The less said about 1911 the better. It was a year of forced liquidation and recurrent disaster to mining enterprise. No great war and no widespread catastrophe destroyed British capital, but the undermining of credit caused by political complications at home and abroad sapped the springs of financial activity. Old business languished; fresh business was timid. In 1911 the total applications for new capital in the London market amounted to

£192,000,000, as against £267,000,000 in 1910. Of the total money found in 1911 the sum applied to mining and exploration issues was £18,400,000, as against £26,735,000 in 1910. Mining on the Rand, which ranks first both as a goldfield and as a depository of capital, has suffered by reason of shortage of labour, disappointing development, and irregularities in management. A futile effort to boom Rhodesian mines culminated, during the close of the year, in a scandal that will further decrease public confidence in the group system. West African mining has been struggling feebly against a persistent malaise, varied by occasional unpleasant episodes. Broken Hill has come to the front with an important discovery of ore and with continued metallurgical progress. In Western Australia the Bullfinch boom found a quick and inglorious finish early in the year. The old mines at Kalgoorlie show further signs of exhaustion. The Great Fitzroy and Great Cobar mines have gone through a period of disappointment. In Tasmania the Mount Lyell has suffered from repeated labour troubles. New Zealand is depressed by the Waihi collapse. The Indian gold mines are doing decidedly better and appear to have penetrated below a zone of impoverishment. Mexican and American enterprises have not been conspicuous, although the record as a whole has been satisfactory. New issues in the Yukon and Northern Ontario have been prominent. Tin mines in Cornwall and the Malay States have profited from high prices for the metal. In Siberia the copper group is doing well and the Lena Goldfields continues to produce gold lavishly at a lavish expense. In general, it may be said that new discoveries and fortunate developments have been overshadowed by several fiascos of the first magnitude, affecting mines and companies of the highest repute. These misfortunes would have been obscured and disregarded during a lively period, but, owing to the general stagnation of the markets, it has been possible for the public to give detailed attention to blunders and to protest against lapses from correct administration. Such exposures have shocked the general confidence, but they will have a salutary effect upon the men responsible for the direction of the vast and multifarious operations of a complex industry.

## Forecast.

The beginning of another calendar year prompts the look backward, but it also incites all but the most hopeless of human beings to look forward. The miner is nothing if not an optimist, and while we have been called upon frequently during 1911 to ask some of our friends to abate an optimism that seemed unreasonable, we appreciate as well as anybody that the exercise of the imagination is a stimulant essential to enterprise. What then will 1912 do for those who are engaged in winning the metals from their rocky encasement? We believe that the year affords promise in many directions. So long as civilization advances there will be growing need of the metals. This is an age of steel, it may be; but it is also an age of copper, zinc, and lead. To the Cornishman every period is an age of tin. To the financier every year is a time for gathering gold. To the mints of the world, as to the jeweler's art, the uses of silver are not to be denied. Civilization indeed has a metallic basis; our monetary systems are expressed in gold and silver; transport depends upon steel; the instant message flashes over the copper wire; the conduits of a complex method of living are made of lead; and to these general uses are added the multitudinous comforts and facilities to which zinc and tin contribute. Such considerations are not merely rhapsodical; the trend of manufacture has emphasized the widening demand for the baser metals. The consumption of copper and zinc is increasing; the scarcity of lead and tin is manifest. We predict more active production for

some of these metals and intensified search for others. The electrification of railroads and tramways points to the absorption of large quantities of copper; the more extended use of the telephone and the electric light calls continually for lead piping; the manufacturers of galvanized iron are taking increased quantities of zinc, and there is a growing demand for the non-poisonous zinc-white paint; while tin is continually required for tin-plate manufacture. We mention these specific applications only as a suggestion of the manner in which the miner's product is utilized. With copper we seemed not long ago to be about to be glutted, but the industrial expansion of the world has rectified the balance, so that even the output of the new mines will be acceptable to the market. For the first time since 1907 a genuine recovery in copper is recorded. The price of spelter has risen from £18 in 1908 to £28, indicating that the zinc miners at Broken Hill, Missouri, and Algeria can dig cheerfully. Lead discoveries have been few during the last decade and we can see good reason for a scarcity of the metal unless new deposits are found to take the place of some that are being exhausted. The price of this metal is higher than at any time since 1907. Tin is produced in so few localities and in so small a quantity that it has become the sport of market speculators. In June 1911 the record price of £233 was reached. A new tin mine anywhere is promised a ready disposal of its product. Thus we conclude that the dominant feature of 1912 ought to be the increase of operations directed to the winning of the base metals.

## Rhodesian Finance.

During the past two years we have had good reason to regard the mining finance of Rhodesia as one of many handicaps to the mining industry of that spacious region. Apparently our critical attitude, based wholly on evidence available to any intelligent observer, is fully justified. After various queer performances, the Amalgamated Properties incident startled the shareholding public by exhibiting the unconventional methods of those in control. Then came the proposed amalgamation of the Rhodesia Exploration and the Gold Fields Development companies. This has elicited criticisms that have almost shamed the subsidized sheets that undertake to advise the unsophisticated speculator. The Rhodesia Exploration company was originally registered in 1895, but it was re-organized to amalgamate with a number of other companies in September 1910. These various companies had been trading in each other's shares, accompanied by option deals between directors, to such an alarming degree as to confuse the whole business and require a new shuffling of the cards. It had become impossible to submit detailed accounts to the shareholders, but by amalgamating, cancelling interholdings, going into voluntary liquidation, and raising fresh working capital for the enlarged enterprise, it was possible to obscure the true position. The Gold Fields Development company was registered in February 1911, as a holding concern to take over 130,000 Shamva, and 25,000 Lonely Reef shares, besides a few odd claims of no pronounced value. Thus the two companies are only from 12 to 15 months old. Meanwhile the Shamva has developed into a fine property, but to no such extent as to warrant a quotation of £4, representing a valuation of £2,000,000. The profit assured is only £750,000. The Rhodesia Exploration holds 110,000 Shamvas, and if that company were to get into trouble, the fictitious price of Shamvas would come down with a run, to the great loss of the Gold Fields. Whereupon it is arranged for the Development company to absorb the Exploration, and thus prevent a collapse injurious to both. As soon as the decision had been reached by those in control, the amalgamation was announced to the public as a step likely to stimulate Rhodesian mining. The subsidized Press

made a timid murmur of approval and nice things were said of the value of Gold Fields management. This would undoubtedly be an improvement, but we have no reason whatever to believe that even capable management can perform the miracle of turning water into golden wine. The watered shares require the dessication of a detached appraisal and a proper audit. The scheme as published is inchoate; it includes neither a profit and loss account, nor an itemized statement of assets. The board asserts that it has not taken the market price as a basis for valuation, but has acted on expert advice. Who are the experts in the case? Anonymous experts afford no security for a trustworthy appraisal. The personal equation is essential to a correct calculation. In effect, the valuation becomes that of the directors themselves, from whom public confidence is withheld at the present juncture. The auditors appear to have been rushed. They confess themselves unable to check some of the figures, and they complain of a lack of time to verify the list of securities. No proper reason exists for such a hurry; ample time should be afforded for a proper investigation of affairs; the unseemly haste of the entire performance necessarily throws doubt on the genuineness of the proposals submitted to the shareholders. These, of course, are helpless, unless public opinion is aroused. It is high time to face the fact that Rhodesian company finance is a hindrance to real mining. Dummy directors drawing large salaries sit on boards to register the orders of one or two recklessly resourceful operators, to whom mines are mere counters in the legerdemain of financial trickery. Working capital is used to dose the market. Directors obtain options on blocks of shares. The public is hoodwinked by cryptic reports. The insiders sell out, retiring under cover of ill-health or political duties. New deals obscure the old ones. The market is galvanized into brief life. Meanwhile mines are being made holes in the ground and the actual work of mining is rendered ridiculous. The position has become intolerable. If a shareholders' committee cannot be appointed to investigate, the Board of Trade should be empowered to intervene with a view to protecting not only British shareholders but Rhodesia itself, whose principal industry is being sacrificed to the exigencies of a spurious finance.

## Labour on the Rand.

During 1911 the scarcity of labour has been intensified in the Transvaal. In this respect the premier goldfield is not unique, for the lack of an adequate supply of cheap labour is being felt all over the world. Yet, owing to the monthly statistics and the controversies over indentured labour, the position on the Rand has come into renewed prominence. We have referred to the subject periodically as one, the real significance of which the shareholding public has failed to appreciate, and also as one that the knowing operators have taken pains to ignore or to minimize. Sir Julius Wernher, in his letter to the Fraser & Chalmers shareholders, referred to the dismay of the big operators when they found that "the native labour required was short 30 or more per cent." The Van Ryn report states that the working cost at that mine increased by 8d. per ton during the past year, mainly on account of the greater cost of labour. Sir George Albu complains of the suicidal competition for labour between mining companies and the growing expenditure therefor. These are among many incidents that indicate the acuteness of the stringency. Numerous companies have debited their impaired earnings to lack of labour. At the end of 1911 the number employed on the gold mines of the Transvaal was 178,282, as against 178,602 a year earlier. The importance of this decrease, though slight, is realized when it is remembered that several big mines entered the productive stage during 1911, and each of

them called for a bigger complement of natives. Further, the diminution has come despite energetic efforts to augment the supply and in face of confident promises that an additional quota would be obtained. The failure to do so is due to several causes. The areas within which recruiting is permitted are continually being restricted. The South African farmer has begun to complain that the recruiters trespass on his labour preserve. The Portuguese authorities are considering an embargo on labour exported from Mozambique, because the natives have shown an extraordinary mortality from phthisis when employed underground at Johannesburg. Unrestricted recruiting in British Central Africa is likely to be regulated in a manner adverse to the requirements of the Rand. Again the Chinese question has arisen. Even the farmers recently assembled in convention at Bloemfontein have been heard to advocate the re-introduction of coolies. This indicates a curious reversal of opinion. It is significant. So also is the complaint that white men are diminishing the effectiveness of the scant supply of Kaffir labour by their tendency to delegate to the native the sort of work they were willing formerly to perform themselves. What small part of manual operations in South Africa is now done by white men is becoming even less owing to the fostering of an idea that such tasks are beneath the dignity of the superior race. This serves to intensify the labour shortage and to create large numbers of 'wasters.' It is a subject worthy of the attention of the statesmen of the Union, for it is fundamental to the industrial and civic advancement of South Africa. To return to the mines : it is true the more extended use of machine-drills has served to economize hand-labour, and the persistent hope survives that a light one-man drill will yet be devised. On the other hand, the spread of phthisis is laid against the machine-drill, which makes so much fine dust. Here also is a problem to tax the highest intelligence of the Rand. Indeed the joyous confidence of former days is gone at Johannesburg and it behoves the technical men to impress upon their directors the urgent necessity for facing these and other unpleasant facts. Efficient labour under healthy conditions is the foundation of all industry.

## Mexican Progress.

We are among those who take a cheerful view of recent political developments in the great mining regions of Mexico. The second great republic of the North American continent has been passing through darkness to light ; from the tyranny of a military despotism, through the turmoil of a revolution, to the safer ways of constitutional government. Some doubt may still linger as regards Francesco Madero's ability to hold together the conflicting interests that he united against Porfirio Diaz, but there is growing evidence for the belief that the country at heart supports him and that the most stable elements desire to give him a fair opportunity to convert some of his ideals into realities. The surrender of General Bernardo Reyes, at Laredo, on December 26, after an ineffectual effort to incite a rising against the new government, is significant. Mexico does not want to become known as a revolutionary country, for that would mean the withdrawal of the capital and brain brought within recent years from the outside to the exploitation of a vast and diversified region rich in natural resources. It is true that several acts of brigandage have been suffered by mining companies operating in Mexico, but these are the inevitable sequel to a revolution, like the smaller shocks that follow a big earthquake. The withdrawal of the local gendarmerie into the chief centres of the revolutionary war tended to leave isolated districts without the usual protection against outlaws. Hence a few managers received visits from bandits, masquerading as patriots,

and had to pay tribute in food, whiskey, or pesos. Since then an earnest effort has been made, not unsuccessfully, to curb such excesses and to make it clear that they form no part of the Maderist programme. They may be set against the equally unpardonable rapacity of the *cientificos* or 'grafters' who throve so well during the last years of the Diaz regime. It required a revolution to shake them out of control in Mexico; we hope that peaceful means may suffice to check the scientific grafters who have battened on the political corruption of the United States. Mr. Roosevelt's "malefactors of great wealth" may occasionally suffer from unwarranted aspersion, but it must be confessed that they, like the anti-social element at the other end of the scale of living, are the foes of representative government in both of the American republics. It was their greed that precipitated the rising under Madero, for what had started as beneficent exploitation degenerated into tyrannic extortion, until Diazpotism became a synonym for official corruption in the interest of foreign capitalists, from the President and Governors of States to the *jefes politicos* and *haciendados* throughout the country. That system has been scotched, if not killed, by General Madero and his supporters. Yet it would appear that the new President is fully aware of the fact that Mexico still requires financial aid from the outside. Encouragement is to be given to foreign enterprise and we take it as a good augury that Señor Luis de la Barra, the brother of the interim president to whom the recent peaceful settlement of affairs is largely due, has been appointed financial agent in London. We learn from Englishmen resident in Mexico that the Minister of Finance, Señor Ernesto Madero, uncle of the President, is a man of recognized ability and enlightened views, opposed to foreign monopolies, such as have been prominent in oil and railway affairs, but quite willing to give proper scope and protection to the enterprising operators who regard Mexico as a profitable field for mining and other legitimate forms of industry. We note with interest that the new Government has in hand a comprehensive scheme for improving the harbour facilities at Guaymas, Mazatlan, Manzanillo, and San Blas, the chief ports on the Pacific coast, important because they afford access to the seaward slope of the Sierra Madre, in which are a large number of promising mining districts. This indicates statesmanlike prevision. The opening of the Panama Canal also will prove a stimulus, we feel sure, to Mexican industry, especially if preparations are made to benefit from sea-borne traffic by improving the western ports of entry. Not only men and money, but modern ideas will flock into Spanish America and contribute toward that general education which is the very foundation of constitutional government. Mexico is not the only country now too advanced for a military despotism or a predatory oligarchy, and yet not sufficiently advanced for representative government. No country is quite ready for truly representative government, which demands a civic spirit too fine for this workaday world. But Mexico is ready for an earnest effort to advance peacefully under a regime constitutional enough to avoid tyranny and forceful enough to curb disorder. Our hopes and good wishes are with the new departure. *Viva Mexico!*

## Wernher, Beit & Co.

Wernher, Beit & Co., as a firm, has ceased to exist. Sir Julius Wernher retires from the diamond branch of the business, which is taken over by a group of former partners under the style of L. Breitmeyer & Co. It will be remembered that a few months ago the gold-mining share assets of the firm were distributed between the Central Mining & Investment Corporation and the Rand Mines, Ltd. Only the diamond branch of the business re-

mained; and this has now been transferred. These changes are due to the fact that the surviving senior partner is feeling both the weight of years and the burden of ill health. Beit died unmarried. Sir Julius Wernher has no son capable of taking his place, and Mr. Friedrich Eckstein's sons are yet too young to enter the business. It is true, Sir Julius remains the chairman of the Central Mining Corporation and retains many important directorships, which will, we hope, long enable him to exert a weighty and sagacious influence. But the famous firm was dissolved on December 31, 1911. Its history is worthy of record in the pages of our young magazine. It originated from the house of Jules Porges & Co., of Paris and London. These were diamond merchants owning a large number of claims that Cecil Rhodes was instrumental in amalgamating into the De Beers Consolidated Mines. When this was done some of the old partners retired and their places were taken by Alfred Beit, Julius Wernher, and Max Michaelis, who then changed the style of the firm from Jules Porges & Co. to Wernher, Beit & Co. In the early days of Johannesburg they turned to gold mining and acquired extensive holdings, which were administered by H. Eckstein & Co. This house became the representative of the firm in the Transvaal. Hence all the business done locally by Wernher, Beit & Co. was effected through the Ecksteins, who constituted the famous Corner House, so named because their office stood at the crossing of two main streets in Johannesburg. It is not too much to say that the subsequent history of Rand mining is in large part the record of the firm of Wernher, Beit & Co. They have controlled the biggest and richest mines, and the largest number of them, such as the Robinson, Ferreira, Heriot, Nourse, Crown, Bonanza, Wemmer, and others now forgotten or exhausted. The senior members of the firm, particularly Beit, always co-operated loyally with Rhodes and gave him financial backing in the effort to turn his imperial dreams into substantial facts. The deep-level properties controlled by them were consolidated into Rand Mines, Ltd., the pioneer of systematic deep mining, and successful largely by reason of the influence and leadership of the firm, which itself and by its following found the enormous sums of money needed for such far-reaching schemes. This marked the beginning of a new basis of capitalization in the mining business and gave international importance to South African enterprise. The £1 shares in Rand Mines rose to £45 and even today, at a time of severe depression, they stand at £28, that is, £7 for each of the 5s. shares into which the original par valuation was sub-divided in 1899. In days of prosperity the firm was a leader, but it proved no less able to face adversity, for during the darkest times of the Boer war, when Rand securities became terribly depressed, it was largely owing to Wernher, Beit & Co. that public support was given to the market, because they showed willingness to contribute their own capital to maintain the credit of the Rand mining industry. In common with the other so-called groups they have been charged with sinister share dealings and market operations of a purely selfish character, and they were probably not immune from the weakness of the financier, who profits by the ignorance and greed of the public; but this much is true: their enterprises were usually conducted with a straightforwardness heretofore rare. They were also conspicuous in being always ready to engage the best professional talent and to pay for it in terms previously unknown. They never hesitated to introduce improvements, to scrap out-of-date equipment, or to follow the advice of their technical staff. During the South African war the firm subscribed generously toward the funds raised to equip volunteer forces, both in England and in South Africa, and they were conspicuous in their kindness to refugees. Their gifts to

hospitals and to the cause of education will not be forgotten. We certainly shall not forget that the lump sum subscribed to the Imperial College of Science and Technology was instrumental in placing that institution on its feet. To conclude: they have used their influence wisely, and they have donated their money to patriotic and civic purposes. In the disappearance of the firm we chronicle the close of an era. It came to the front in the halcyon days of South African enterprise, and it passes out of the record at a moment when the mining industry of the Transvaal in declining from its zenith. It is a coincidence that Wernher, Beit & Co. should be dissolved just when it is becoming recognized that the glory has departed from the Rand.

## New Year's Honours.

The honours conferred by the Crown on the advice of the Prime Minister are rendered interesting by the further distribution of titles among the plutocracy of the Rand. Baronetcies are conferred upon Messrs. George Albu, Lionel Phillips, and Sigmund Neumann. None of these are surprising and all of them will gratify large groups of friends. Two of the honours mentioned appear to be most appropriate as giving a *cachet* to careers of productive energy and honourable distinction. The new baronets serve as a link between technology and finance, especially Sir George Albu, who has long been highly regarded by the technical men of the Rand for his intelligent understanding of those intricate operations whereby a hole in the ground is converted into a treasure-vault. Concurrently with the bestowal of honours by the Crown, we are enabled to record the equally worthy distinctions conferred in the technical world by the Institution of Mining and Metallurgy. The gold medal awarded periodically has been given to Mr. Edward P. Mathewson, who may without exaggeration be regarded as the leading copper metallurgist of his day and generation. Mr. Mathewson is a Canadian by birth and one of a band of successful metallurgists hailing from McGill University, whence he graduated in 1885. Commencing his smelting experience at Pueblo, in Colorado, he subsequently went to Mexico in the employ of the Guggenheims. Owing to a difference of opinion he resigned from their service, but for this we shall not blame him. His early work was in lead smelting, and those who know of his later specialization in copper metallurgy may not be aware that he was recognized as an accomplished lead specialist in the early part of his career. Entering the service of the Amalgamated Copper he soon rose to the chief position as smelter manager at the Great Falls and Anaconda plants. He introduced many improvements, notably the linking of blast-furnaces into huge units. The new plant of the International Smelting Company in Utah was designed by him. But beyond mechanical improvements, he has trained many capable recruits in metallurgical engineering. The development of an efficient human unit is more than the construction of a furnace, inasmuch as a man is more than a machine. For this very reason the award of the medal to Mr. Mathewson will, we know, be acclaimed by a large number of former associates and friends in distant corners of the earth. The medal donated by the Consolidated Gold Fields of South Africa for important work in gold metallurgy is given to Mr. Walford R. Dowling for his excellent paper on 'The amalgamation of gold in banket ore.' Mr. Alexander M. Finlayson wins the premium of 40 guineas for his paper on 'Secondary enrichment in the copper deposits of Huelva.' The student prizes go to Messrs. F. Percy Rolfe and Arthur C. Hoare. Finally, a gold medal has been awarded to Mr. Walter McDermott "in recognition of his special services in the equipment of the Bessemer laboratory of the Royal School of Mines and as the representative of the Institution

on the board of governors of the Imperial College of Science and Technology during the period of its establishment and organization; and to signalize his services in the advancement of metallurgical practice." If we may be permitted to add anything to the appropriate terms of this award, it will be to emphasize the public spirit and professional good-fellowship of the recipient. He has made himself an essential factor in any movement designed to improve the standing of the profession or promote its solidarity. As a mining engineer he won his spurs before most of the fathers of the young men now graduating at South Kensington were out of the nursery, and as a specialist in machinery he has had a career both long and honourable. We do not rate popularity highly, but when it can be won without the sacrifice of character it adorns a man's life. Such an adornment belongs to Mr. McDermott and with it he receives the more substantial appreciation of good work done. We conclude by saying that the honours conferred by the Institution command general approval and justify it as a court of award.

## El Oro.

We commend the frankness of the report sent by Mr. R. T. Bayliss and the promptitude with which that report was issued by the board as an example to the smart people who direct Rhodesian mining affairs. The manuscript arrived in London on December 29 and despite the intervening holidays it reached the shareholders in print on January 3. Moreover, there was no apparent leakage of information; for El Oro shares did not budge until January 3, when they dropped at once from 22s. to 17s. 6d. The advice given by Mr. Bayliss, in consultation with Messrs. R. M. Raymond, Alfred Main, and Philip Foster, is undoubtedly sound. He concludes that the upper portion of the San Rafael vein has been sufficiently explored and that its possibilities at that horizon are exhausted, although the ore remaining will last for three years. The lower portion of that big lode, from 550 to 1000 feet, has proved disappointing in the north end, but invites exploration in the southern ground. On the 1300-ft. level some good ore has been found, enough to warrant further development. The West vein has yielded ore from 786 to 1300 feet and also offers good prospects in the northern portion of the mine. This vein is apparently of later origin than the San Rafael and maintains its identity even in a near approach to the older lode. The San Patricio has behaved like the San Rafael in becoming impoverished at the same level and reasonable hope exists that it may also prove productive in the deeper southern workings. Another vein, called the No. 4, has yielded some low-grade ore and appears to be identified with the Victoria, which was cut in the Somera claim some years ago. Results must have been not wholly unsatisfactory as Mr. Bayliss recommends that it should be further tested. Owing to recent developments in the mine and the fear that labour troubles may follow the change of government in Mexico, it is suggested that the resources of the company be husbanded with a view to systematic exploratory work pending the exhaustion of the remaining reserve of ore. The accumulated tailing is to be treated and the extraction of ore limited to 20,000 tons per month, yielding an annual profit of £150,000, which is a decrease of £50,000 per annum. Knowing the mine we are prepared to give our prompt approval to these wise recommendations. The San Rafael became rapidly impoverished at the bottom of the zone of oxidation and we marvel that the mine should have done so well so long. Anyone familiar with the El Oro will allow that good management has prolonged the productive period of the enterprise and enhanced the profit won during the last six or seven years.

## Sub-Arctic Mining.

Among those who foregathered at the annual dinner of the Institution we noticed a number of practitioners identified with Siberian mining. This reminded us of the importance of a region heretofore but little known. Indeed, the geographical aspect of mineral exploration is not its least fascinating feature. The mining engineer makes the whole world his field. Of late he has penetrated into the boreal latitudes of Siberia, in search primarily for gold and copper. At least three copper enterprises of the first rank have been developed in Western Siberia and the most productive gold-alluvial mine in the world is in the frozen plains of the Lena. Farther afield, near the Okhotsk sea, an English company has started dredging operations with a modern equipment. We are told that large tracts of gold-bearing alluvium and drift are available in Eastern Siberia, and we know that some of them are now undergoing trial. Despite governmental restrictions and local regulations of an occasionally irritating character, the British and American operators who have undertaken to exploit mineral deposits under the Russian flag are making excellent progress, and have achieved successes such as will incite others to follow them. On another continent, in the Far North of America, the mining operations in the alluvial flats of the Yukon and Alaska are doing so well as to attract attention. In the Seward peninsula, washed by Bering Sea, there are no less than 22 dredges at work. In the Klondyke district, the feverish digging of boom days has been followed by systematic dredging, hydraulicking, and mechanical elevating of gravel on a big and profitable scale. Knowing something of the conditions of mining in the sub-arctic regions of both Asia and America, we are convinced that they afford plenty of scope for successful exploration. The area covered is enormous, from east to west it reaches half-way round the earth, and for a distance north-south of fully 1000 miles. The larger part of this vast territory has yet to be inspected by the experienced prospector. For eight months in the year the surface of the ground is not visible, and the search for minerals is practically impossible on account of snow and ice. It is a hard country for the prospector and for the men who start an enterprise, but once established it is no more difficult or unpleasant to operate a mine in this northern territory than in a temperate clime, and vastly more salubrious than in the tropics. The malaise that kills the virility and energy of the white man in West Africa or Central America is replaced by a glorious vigour and an intensified activity that it is a delight to see. The protracted daylight of five or six summer months affords an opportunity to do an enormous amount of surface work, and when the winter comes the operations underground need not be hindered by snow or wind. What if washing of the gravel or stamp-milling of the ore is restricted to five months; that period is long enough to permit a handsome winning, if the output of the mine be rich. Moreover, during the winter months the gold-bearing product, whether gravel or quartz, is accumulated, and there is a chance of obtaining that ideal state of affairs when there is more than enough material for the reduction works. The copper mines and smelters, once past the stage of construction, are not harassed by winter snows. Frankly, we believe that the worker in Alaska, for instance, accomplishes as much in six months as his brother in the jungle does in a whole year. We view with favour the expansion of mining activity in sub-arctic territory, and we commend the subject to the enterprising. Further discoveries are likely as experienced men wander intelligently over the waste spaces of these regions. Rumours have come of a find of gold near Baffin's Bay, and more recently telegraphic dispatches have told of a rush to the headwaters of the Sixty Mile, a tributary of the Yukon, and near the Alaskan boundary. Be-

tween the new goldfields of Ontario and the Arctic coast there is a continental area yet to be prospected. This will follow as the railways extend from the frontier and miners obtain facilities for search. The migration to Siberia began with the finding of gold by soldiers in the Nerchinsk district and the subsequent working of alluvium on the Yenisei. Since then the mining frontier has been extended to the Bodaibo. Parts of Siberia are comparatively inaccessible and quite shut to the ordinary prospector, who must follow in the wake of organized enterprise, such as that of the Lenskoie company in the Bodaibo district or the Orsk Goldfields in the Primorsk. These subarctic regions in Asia and America now yield £7,000,000 per annum in gold; the amount is large enough to invite investigation. As a contribution to the subject, we publish two timely articles, one on 'Winter Mining in Siberia' and another on 'Dredging in Alaska and the Yukon,' both by engineers of wide experience

## Tomboy.

At the beginning of a new year it is pleasant to turn to cheerful topics wherever they may be found. To those engaged in mining the story of the Tomboy furnishes a chapter of honourable dealing and skilful management such as it is a pleasure to recall. In our last issue we referred to the purchase of the Revenue claims and the consequent extension of the life of this enterprise by the acquisition of fresh ore-bearing territory. That was done once before, when the Argentine mine was purchased in order to restore fortunes brought low by the disappointing development of the Tomboy. For the original Tomboy was a flat failure. This mine near Telluride, Colorado, was brought to a productive condition in 1894 by an American group headed by Messrs. O. P. Posey, William Bayly, and F. L. Underwood. A company was incorporated with a capital of $2,000,000 in $10 shares. In 1897 a controlling interest to the extent of 51% was sold to an English syndicate, mainly representing the Exploration Company, acting on the advice of the late Hamilton Smith. Among the other participants were the Mining and Financial Trust, the Mines Selection Co., E. (now Sir Ernest) Cassel, W. Brodrick-Cloete, and Henry Bratnober. Besides the experienced operator last mentioned, the mine was examined by Mr. John B. Farish and the late James D. Hague, both of whom participated personally. The late Charles A. Molson made an examination for the Mines Selection Co. The late John C. F. Randolph examined the mines for the Exploration Company. Mr. Charles M. Rolker had previously made an inspection for Messrs. Richardson & Chadbourne and had taken steps to obtain an option, but he was forestalled by Mr. Farish, acting in association with Mr. Bratnober. Thus the business involved a large number of well known people and it is remarkable that they should all of them have been deceived as to the real value of the mine. On June 7, 1899, the undertaking was registered under the English Companies Acts and the head office was transferred from New York to London. The authorized capital of the new company—the Tomboy Gold Mines Company—was £300,000 in £1 shares, all of which were issued and paid-up. The purchase was effected by the issue of 299,993 shares to the nominees of the American company, so that no cash was involved. The remaining shares went to the seven subscribers to the memorandum and articles of association of the English company. Besides the recommendation of Hamilton Smith, and other experienced engineers, the English speculators acted on the report of Charles A. Molson, who estimated 81,000 tons available, with a prospective profit of $750,000. Each hundred feet in depth was calculated to yield from $500,000 to $700,000 net profit. The bottom of the mine was "in very good condition." This was in December 1896.

The Tomboy mine began to give signs of impoverishment almost from the moment when the English company was incorporated. In July 1900 the manager, Mr. John Herron, wrote to say that the ore above the 200 ft. level was exhausted and that most of the ore opened up between the 300 and 600-ft. levels was too poor to be treated profitably under the rate of expense then obtaining, namely, $8·50 per ton. The shaft was sunk to 1000 ft. and exploratory work was undertaken at intermediate levels, only to prove that the vein was reduced both in size and richness. As a matter of fact, the Tomboy lode was never much good below its crossing with the Iron vein; above this intersection, to the surface, an orebody having a maximum length of 2700 ft. had been proved, in 1899, along the second level. At the time of inspection, before the transfer to the English company, the stopes extended in places to the surface, 150 feet overhead, and two winzes, 58 and 143 feet in depth, had tested the persistence of the orebody. The evidence was deemed sufficient to justify an estimate of ore to yield a profit amply warranting the capitalization of $1,500,000. In the sequel, when the winzes had been sunk deeper and an adit had been driven to cut the vein 500 feet lower down, it was proved that the shape and position, and probably the richness, of the orebody were due to the intersection with another lode, forming a scissors crossing, the hinge of which dipped flatly westward, so as to cut off the orebody along a plane sloping 7° 30′ from the horizontal. The ore reached from this horizon to the surface, and faded about 100 feet underneath. It remains to say that the crossing was visible in the east end of the upper stopes, but only to an observer of highly trained powers, and, even if noted, its real importance could not have been anticipated from the evidence in the upper workings. To make a long story short, the company ceased to operate the Tomboy mine in 1903, letting it to tributers, who gleaned the old workings for six years. It is now completely abandoned. The mine yielded, to the company, 110,000 tons of a gross value of $1,275,000, giving a total profit of $345,500.

Now comes the pleasant part of the story. When the Tomboy began to give signs of rapid impoverishment, the manager, Mr. John Herron, commenced to look about for a neighbouring property that might restore the vitality of the enterprise. In 1900 an option was taken on the Argentine group of claims, and active prospecting was commenced at once. The price for this additional property was only $65,000, and a profit of $122,000 was made from ore extracted before the purchase was completed. The examination of the Argentine was made by C. A. Molson and by Mr. John Herron. It is a fact that the sampling showed $7 per ton, ore carrying visible gold being excluded, but the mill-yield averaged $28 per ton. In this case the result exceeded reasonable expectation and it affords a rare example of an incorrectly low appraisal due to a 'reduced' assay-value. Since its purchase the Argentine has yielded 989,000 tons, giving a gross return of $8,460,000, from which a profit of $3,412,000 has been won. At the present time the ore in reserve is estimated at 400,000 tons, or enough for four years at the average rate of extraction. From this a profit of £60,000 per annum is expected, equal to 4s. per share. Thus the Argentine should yield altogether $4,612,000 in profit on an original purchase price of $65,000. The bottom workings are 600 feet below the surface and the impoverishment noticeable has impelled the management again to acquire additional property. In July 1911 the Revenue property was acquired for $400,000. The ore assured was estimated by Messrs. R. M. Raymond, Philip Foster, and David Herron at 137,914 tons, averaging about $9. Above the upper adit there is 600 feet of ground unprospected save for some old shallow workings on the

crest of the range and there remains several thousand feet in length of ground only partly explored. Owing to improved equipment and capable administration, the operating cost of the Tomboy company has been brought down to $4·50. The shareholders have received £570,000, or 38s. per share, in dividends. This is equivalent to 190% on their original investment. They can look forward to many years of further return on their capital, and they can tell themselves, as we tell them, that no management has shown a keener regard for the interests of shareholders or a more proper appreciation of the trust reposed in directors. For this result they are indebted largely to Mr. R. T. Bayliss, who has been consulting engineer to the company since its incorporation in 1899. Mr. John Herron's special services were recognized in 1901 by the award of 1% on the net profit made by the company; this has given him from £580 to £1100 per annum. In 1902 he was compelled to retire on account of ill health and was succeeded by his brother, Mr. David Herron, who is still the resident manager. It remains to say that the three mines mentioned, successively acquired by the Tomboy company, are situated in Savage basin, a rocky amphitheatre in the very heart of the San Juan mountains of Colorado and at an altitude reaching from 12,000 to 14,000 feet above sea-level. Snow covers the ground for half the year and frost-shattered debris mantles the veins along most of their outcrop. Aerial ropeways have replaced pack-mules and large mills at the mine have replaced the plant in the valley, but the locality remains as bleak as it is rugged, and as difficult of access as it is picturesque. Labour troubles, culminating in guerilla warfare and cowardly assassinations, have joined with snowslides and blizzards in testing both the moral and physical courage of those who direct the operations. These facts also belong to the economics of the Tomboy enterprise and serve to prove that whether in Colorado or in London the men serving the company, that is, the shareholders, have proved that mining can be made an honourable business and a beneficent industry.

## Selling Tin Concentrate.

Two months ago we recorded an alteration in the regulations of the London Metal Exchange affecting the official method of buying and selling metallic tin. The innovation was practically the abolition of an old custom based on conditions that do not persist nowadays. It seems to us that the example of the metal merchants might with advantage be followed by the Cornish mines and smelters, and a clean sweep made of the present system of buying and selling tin concentrate. Other people, from time to time, have made the same proposal and protested against the present method, which has nothing in its favour except the fact of its existence, but all to no effect, and the rash proposers have usually succeeded only in raising the ire of the smelters and the humorous contempt of the miners. There is no doubt, however, that at the present time some of the smelters would welcome a change that would bring Cornwall into line with the rest of the tin world, and the miners would readily agree if the smelters actively urged the alteration. The manager of Dolcoath, Mr. R. Arthur Thomas, has publicly advocated a change, but he received little or no support, a circumstance partly due to the indifference of the miners and partly to their fear of the smelters. We take this opportunity of again urging the two sides to come together and agree to buy and sell on the basis of net dry weight.

As is well known, most of the production of the Cornish mines is sold at the ticketing held on Mondays, fortnightly, at Redruth. On the preceding Fridays, the smelters send their representatives to the various mines to sample the parcels of concentrate offered for sale; in some cases where distance or other

circumstances make it inconvenient for samplers to attend, the smelters accept the samples supplied by the mines. In all cases the concentrate is in a wet condition carrying from 6 to 12% moisture, according to the fineness of the material, and the samples represent the bulk as to both tin and moisture. The bids are made on the wet concentrate and the smelter expects to receive the bulk in the same condition as the sample; in fact, the contract is not complete until the whole parcel has been delivered and weighed by the smelter. There are several reasons, however, why the moisture of the sample should not in practice coincide with that of the bulk. If the sample is carefully taken and sealed, there should be no evaporation between the sampling and the assay, but substantial loss can be caused by evaporation of the moisture in the bulk of the parcel. On the other hand, the smelters may easily suspect a mine of keeping the moisture to a minimum during sampling and of liberally watering the parcel subsequently. The only logical way is to re-sample the parcel on delivery, but this is never done, so it is possible that the buyer may sometimes be paying for water at the price of tin.

Another illogical practice relates to the method of fixing the tare, that is, the weight of the bags in which the concentrate is delivered. The actual weight is never ascertained. The sacks of concentrate are weighed in couples and a 6-lb. 'sack weight' is added to the opposite beam. This is supposed to represent the weight of the two bags if they contain no more than 3 cwt. each. If the load is more than 6 cwt., the smelter is allowed to deduct an additional 1 lb. per pair, and if more than 7 cwt. an additional 2 lb., on the supposition that the bags for the heavier loads must be stronger and therefore heavier. The sellers are naturally careful that the bagfuls shall not exceed the 3-cwt. limit. On the other hand, the 3-lb. allowance may sometimes be less than the weight of the bags, so that the smelter is then paying for jute at the price of tin.

A third anomaly in the transactions is that the smelter is allowed to deduct from the weight of his purchase 3 lb. for every hundredweight. The consequence is that the mine has to deliver 2300 lb. for every ton. Here the 'ancient custom' is decidedly in favour of the buyer, and the smelters are wondering how long the mines will stand the imposition. We believe, however, that the mines consider this allowance as a safeguard to the smelters against variations in the amount of water present.

In addition to the disadvantage of a commercial nature incident to the vagaries of custom as detailed above, an element of obfuscation is introduced into the statistics and science of production and concentration. What with wet and dry tons, allowances for tare, and strange tons, it is impossible to calculate the exact production and percentage of recovery, or to estimate the total metal extractable from the output of concentrate. All these elements of confusion would be removed by adopting the commonsense method of buying and selling as adopted elsewhere. The smelter's assay and bid ought to be made on a dried sample, and on delivery the gross weight of the parcel, including moisture and bags, should be taken, the bags afterward weighed exactly, the moist concentrate sampled again for moisture, and payment made for the net dry weight of the concentrate. The mines and smelters would then know their exact position, and the former would be able to compare the prices bid at the ticketings with those that might be offered by foreign buyers. Our readers who are familiar with Cornish conditions will agree that we have arrived at a convenient point to lay down our pen. If we pursued the matter further we should enter the realm of acute controversy and thus vitiate our efforts to bring about a much needed reform.

# SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

## TOKYO

**Visit of American Engineers.**—The American Institute of Mining Engineers has the pleasant custom of holding a session each year in some mining district, and, from time to time, in connection with such a meeting, excursions are made to points of interest within or without the United States. Thus Canada, Mexico, England, Germany, and Panama have each been visited. This year, following the meeting at San Francisco, a party of 86 members and guests extended their trip to Japan. In the party were representatives of many of the great mining companies of America, and experts in almost all branches of mining. The visit of such a party to Japan was accepted by the Japanese as an occasion for cultivating good relations, and this was so successfully accomplished that the whole party will return to America deeply impressed with the friendliness of the Japanese. The local committee, under the chairmanship of Baron Shibusawa, included representatives of the Mining Institute of Japan, of the Japanese members of the American Institute of Mining Engineers, of whom there are nearly fifty, of the Government bureaus, chambers of commerce, and other important bodies. Elaborate excursions were arranged, by special train and steamer, to the principal points of scenic interest, and banquets followed each other in bewildering succession. The arrangements were excellently made. Among those offering special entertainments were the Imperial Universities at Tokyo and Kyoto, the cities of Yokohama, Tokyo, Kyoto, Nara, Osaka, and Mujajima, the Minister of Foreign Affairs, the Minister of Agriculture and Commerce, the Chiku-Ho Coal Miners' Association, Baron Sumitomo, Baron Fujita, Baron Iwasaki, Baron Mitsui, Mr. Furukawa, and the Mining Institute. The party attended a garden party in the Imperial grounds at Tokyo to meet the Empress, and at every point special courtesies of the same sort were extended. While these functions left a minimum of time for visits to mines and smelters, they did serve the main purpose of permitting the American engineers to become well acquainted with their Japanese professional associates. Visits were, however, made either by the main party or portions of it to the Shisaka smelter of the Sumitoma company, where the ores of the Besshi mine are reduced; to the Imperial Steel Works at Yawata; to the Nuke collieries; the Hasami gold mine; the Nikko refinery of the Furukawa Mining Co.; the Ashio copper mine and smelter; and the mining schools at Tokyo and Kyoto. Following the excursion proper several members of the party visited the Kosaka and other mines in Japan, while others extended their journey to Korea, returning to America by way of Siberia and Europe. A few are returning by way of Hong Kong and India.

The mineral production of Japan now amounts to 100,363,174 yen, having doubled in the last ten years, though standing nearly stationary for the last five. The most important item is coal, amounting in value to practically half the total. The second largest item is copper, amounting in 1910 to 111,780,058 pounds, worth 26,475,499 yen ($13,237,799) and thus accounting for over one-fourth of the mineral production.

**Copper Mines.**—The three great copper mines of Japan, the Ashio of the Furukawa company, the Besshi of the Sumitomo firm, and the Kosaka of the Fujita firm, are all large and important enterprises. The Kosaka, where open-pit work and pyritic smelting have permitted large and cheap production, has probably now passed its prime and must relinquish its position as the largest metal mine in the Far East. The ore at Kosaka is an extremely refractory mixture of pyrite with zinc blende, galena, and barite, with less than 2½% copper and little gold and silver. That such a property should be profitably operated on a large scale is a tribute not only to the cheap labour, but to the excellent technical work of Japanese metallurgists. The Ashio mine, now the largest producer, was described by T. T. Read in the *Mining & Scientific Press* of October 14, and details need not be repeated. It is sufficient to say that the mine contains roughly 100 miles of workings and that the ore reserve is now calculated to amount to 10 years of the present production. A larger output, however, is to be expected, as a new mill is being built at the mouth of the Tsudo tunnel and the refinery at Nikko is also being enlarged. The new units of the refinery will employ the usual methods of

electrolytic refining. In the present plant the plates are coupled in series as at Baltimore and Laurel Hill, Brooklyn. This, while it gives a satisfactory product and a quick turn, thereby being economical in interest charge, involves more labour and probably a higher total cost. The Besshi mine yields an ore that does not need to be concentrated, and at this property also there is the advantage that no pumping is necessary. It is not improbable that in 1911 it may prove to be the premier producer. Between any two of the three mines, however, there is little difference in point of production. At both the Ashio and the Shisaka smelters the sintering problem is being met by pot-roasting. At Ashio briquetting is also done, an extremely satisfactory and simple machine having been built by the mechanical engineers of the company. At the Shisaka smelter coal is brought and coke is made on the ground, the waste gas being employed for generating steam. At Ashio coke is brought over the pass. A railway now being built to the mine will reduce the cost of this and other materials. At all three mines water-power is abundant, and at the Besshi improvements are now being made whereby a stream will be diverted through the mine and dropped 2000 ft., furnishing abundant additional power. At the Besshi, too, a new adit 16,000 ft. long is being driven to tap the orebody 2000 ft. below the present adit. A round, brick-lined shaft, 16 ft. diam., is being sunk in the mine to meet the new adit.

**The coal production** of Japan comes mainly from Kyushu, though important mines are being opened in Hokkaido and the principal coal reserve is now in that northern island. At the Muke colliery of the Mitsui company, in Kyushu, the coal has been mined for two miles along the strike and nearly the same distance on the dip, which is 10°. The bed averages over 9 ft. in thickness, being in places as much as 25 ft. The roof is a hard sandstone and the floor a firm fire-clay. The coal is strongly coking and is used at the Imperial steel works, aside from which there are ovens at the colliery. A new bank of Koppel by-product ovens is being built at the mine and the waste gas will be used for power in two 2000 kw. gas-engines of German make. At present power is generated from steam, three 5000 kw. Curtis turbines being in use at a central station, aside from numerous separate plants. There are six pits, the deepest being the Manda, 900 ft. deep, from the bottom of which an endless-rope tram extends 3000 ft. on the dip. The coal lies favourably for mining, except for the irregular cleavage. It is mined by pick alone, without powder or undercutting. This makes a large proportion (40%) of fine coal, but the latter is all usable in the coke-ovens. The principal extra expense is for pumping. For the field as a whole about 10 tons of water per ton of coal must be raised, but at the Manda pit the ratio runs as high as 20 : 1. For this work a variety of pumps are in use, including Janesville, Knowles, Worthington, Evans, Schleifmuhle, and Davey types. The Davey Cornish pumps at the Manda shaft are said to be the largest operating at any colliery in the world. The stroke is 12 ft. and the steam-cylinders are 45 and 90 inches for high and low pressures respectively. A harbour, docks, railways, and other engineering enterprises have been constructed in connection with this colliery.

**Technical men.**—A striking feature of the mining industry of Japan is the employment of a large number of technically trained men. When the country was opened there was no mining by modern methods and but little metal was used. While many mines had been opened, the whole scale of operations was small, and iron, for example, was so scarce that at the tomb of Ieyasu at Nikko is shown an ornamental iron lantern that cost, when made, a fabulous sum. The large-scale operations now under way are all the result of recent work. The new miners of Japan inherited only mines; no outworn plant and no hampering prejudices. As a result they have been able to adopt the best and most modern methods. Just as they had no old plants, they had no corps of 'old Cornish miners' and 'practical miners' such as so largely handle details in England and America. Most of the miners in Japan today come from the farming class. They must be trained to the work and closely supervised. They make excellent miners, a single-hand man in one of the mines visited was getting in 60 good blows per minute, but they require a larger number of overseers than in America. Accordingly Japan is the paradise of the recent technical graduate. In no other country do its sons trained in mining have so large a field, and are so quickly entrusted with responsibility. At one of the plants visited by our party was a large concentrator, and a good one, designed and erected by a graduate of Tokyo University within three years of the time he left school; and even more striking instances might be mentioned. At one colliery 11 University graduates sat down at the hos-

pitable club-table with their visitors, and indeed it is almost impossible to find an important department at any property that is not in the hands of a man from one of the Japanese or some foreign school. At every plant visited the American engineers found old friends and school-mates, though already positions are being filled mainly with graduates from the Japanese mining schools. Practically no foreign mining engineers are now employed. One incidental feature of the use of so many educated men is that the living quarters of the staff seem to be uniformly excellent, and even at small properties reached by horse-back the visitor is apt to find most, if not all, of the 'comforts of home.' Another striking feature of the mining industry at present is the tendency toward shorter hours. At the larger mines the miners and other skilled employees work only 8 hours, as in America. Surface work occupies 10 to 12 hours, as elsewhere. While there are no unions, the men form what are practically guilds, with their own customs and regulations, and the operator deals usually with a master contractor or a group of contractors, much as his American associate deals with the walking delegate or the pit committee. Japanese companies, however, are more paternal and watch carefully the living conditions of their men. At least one furnishes boiled drinking-water in each miner's house, and has a system of rigid sanitary inspection. The cost of living is increasing in Japan as elsewhere and, as conditions change, the few remaining differences between mining in Japan and America will be still further minimized. Already the Japanese are less adopters than adapters, and they are beginning to be inventors. When their relatively large form of technical advisers once get their excellent labour trained to new methods so that the routine operations go smoothly, they will have more time to devise improvements and then they will deserve even more than now their title of 'Yankees of the East.'

*WHEAL FRIENDLY MINE, ST. AGNES.*

## CAMBORNE.

**Phœnix Mines.**—These mines are situated near Liskeard, in what Francis Allen, chairman of South Crofty, at a recent meeting described as an unfashionable part of Cornwall. A large sum of money has already been spent in re-opening the mines. The late William Polkinhorne, for many years purser, found from the books of the company that from 1843 to 1889 copper ore to the value of £436,239, and tin ore valued at £880,844 had been extracted. From 1907, when the present company took possession, up to 1910, black tin to the value of £5600 was sold, so altogether the production from this famous group has been close on 1⅓ million sterling. The present owners have spent to date about £35,000 on machinery and plant,

and the expenditure on development up to June 30 last amounted to close on £31,600. The working capital provided at the start was £60,000, and this now being exhausted, a 6% debenture issue of £30,000 has been created, of which for the present it is proposed to sell one-half. Of this Bolitho & Sons, of Penzance, have subscribed £7000, and £4000 has been promised from other sources; so only £4000 remains to be secured, and no difficulty is anticipated in obtaining it. A change in the management has recently been made and William Thomas is now in charge. The new main shaft was down 798 ft. on December 4 last, and it is proposed to sink it to a depth of 200 fathoms, or 16 fathoms beneath the lowest workings of the old mine. This shaft is equipped with powerful Cornish pumps, started in June 1909, but to enable the old workings to be drained concurrently with the sinking of the shaft, a pump is being installed in the Old Sump shaft to bring the water through the 720-ft. cross-cut to the main pumps. In the eastern section of the mine, Stowe's shaft has been equipped to the 50-fm. level below adit, and it is proposed to instal two small pumps to unwater this section so as to enable the shaft to be sunk to the 100-fm. level and connect with the old workings. From the report it appears that in forking the old mine to 744 ft. below adit, approximately 131 million gallons of water was pumped in 151 days at a fuel consumption of 2·75 lb. coal per horse-power-hour.

**St. Agnes Consolidated.**—Reports by Ferdinand Dietzsch, the company's consulting engineer, and William Thomas, of Camborne, have recently been issued on this property in the St. Agnes district. The company is appealing for further funds to the extent of £60,000, to provide additional stamping power and equipment for West Kitty, and presumably in part to meet existing liabilities, seeing that the consulting engineer estimates that an expenditure of £39,052 will cover his proposals. The capital of the company is £175,000, of which £137,500 has been issued, while £125,000 in 6% participating bonds has been authorized, and £35,000 subscribed. If the further bonds now offered are all taken up, the issued capital of the company will be £232,500. I fear that with all the possibilities of West Kitty and East Blue Hills, the only properties of the group receiving attention, it will be many a long day before the profits will be sufficient to pay a dividend on so huge a capital. Mr. Thomas speaks highly of the recent discovery in the cross-cut at the 80-fm. level between Friendly and Reynolds' sections, and he anticipates that by deepening the shafts on those properties the lode will be intersected in each, thus opening up a new mine underneath the old one. The letter accompanying the reports states that "when the full 60 stamps are completed and in full work, it is estimated by the engineers that they can deal with at least 200 tons of ore daily, which, taken at the moderate assay-value of 45 lb. of tin oxide per ton, would yield about 4 tons of tin oxide per day, or 100 tons of tin oxide per month, equal to over £10,000 in value." In face of the fact that the ore being milled at West Kitty shows a recovery of less than 14 lb. per ton, and that only low-grade ore has so far been opened up at East Blue Hills, 45 lb. recovery on a monthly tonnage of 5000 is rather an optimistic anticipation, especially at this stage in the development of the recent discovery. However, I am a great believer in West Kitty, and if the company had been moderately capitalized, I believe investors would have had no reason to regret their connection with the property.

**Mineral Production of Cornwall and Devon.**—From the belated statistics issued by the Home Office, it appears that the total value of the mineral production of Cornwall and Devon for 1910 was over one million and a half sterling. The value of the metallic minerals produced was £717,695, and of the 'earthy' minerals £839,171. I give below the tonnage and value of the principal products, and would refer those requiring more complete data to the tables prepared by the London & West Country Chamber of Mines.

| | Tons. | Value. |
|---|---|---|
| | | £ |
| Arsenic | 2153 | 17,602 |
| Copper | 870 | 2,797 |
| Tin Ore | 7572 | 655,871 |
| Wolfram | 259 | 27,593 |
| China Clay | 773,261 | 534,936 |
| Pottery and other Clays | 332,671 | 87,262 |
| China Stone | 68,707 | 31,036 |
| Granite, etc. (Igneous rocks) | 470,971 | 120,620 |
| Slate and Slabs | 27,182 | 32,517 |

**Wheal Kitty.**—The sinking of Sara's shaft has been resumed with two rock-drills and good speed is being made. It is anticipated that the Wheal Kitty lode will be intersected within the next few months, and when this has been done, a large area will be available for development. The 65-in. Cor-

nish engine installed at this shaft is easily dealing with all the water. The grade of the ore milled continues low, the recovery being about 20 lb. per ton. Unless the working cost has been materially reduced, it looks as though there will be no profit to show on the working for the past half-year.

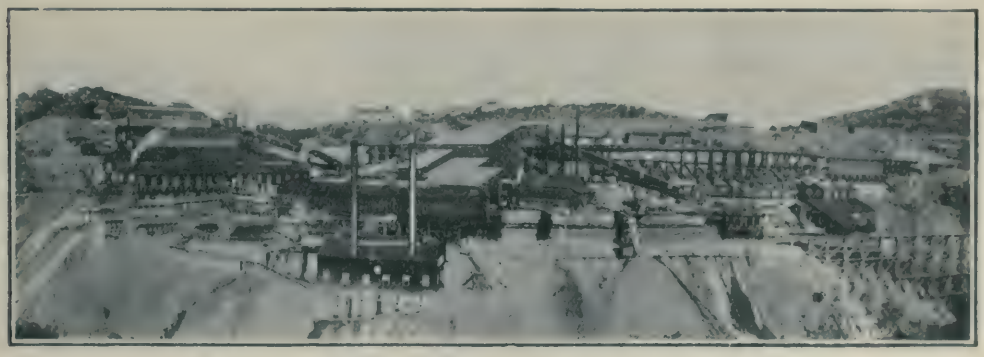
**Tin Ticketings.**—Below I give a three years' comparison of the quantity and value of the black tin production of the principal Cornish mines gathered from the tin ticketings held fortnightly at Redruth.

| | 1909 | | 1910 | | 1911 | |
|---|---|---|---|---|---|---|
| | Tons | Value £ | Tons | Value £ | Tons | Value £ |
| Dolcoath | 1892 | 153,283 | 1718 | 160,327 | 1699 | 197,894 |
| Carn Brea & Tincroft | 1076 | 75,377 | 930 | 73,756 | 776 | 82,787 |
| Basset | 812 | 61,696 | 653 | 61,818 | 553 | 68,067 |
| South Crofty | 681 | 52,279 | 632 | 56,652 | 678 | 76,273 |
| Grenville | 644 | 50,275 | 614 | 56,770 | 594 | 70,305 |
| East Pool & Agar | 587 | 46,323 | 507 | 45,581 | 476 | 53,588 |

The total quantity of black tin sold at the ticketings and values are as follow :

| | Tons | Value |
|---|---|---|
| 1909 | 6970 | £539,245 |
| 1910 | 6102 | 549,079 |
| 1911 | 6151 | 702,587 |

the United States Smelting, Refining & Mining Co., which employs a bag-house to remove the solid particles from the fume and dilutes the escaping gases by blowing air into the stack, has managed to continue in operation, but recent reports are to the effect that injunctions will be secured against the operation of this plant also. In addition to making every effort to prevent damage from fume, the management of the plant also maintains a weather-observing station, keeping a continuous record of the direction and velocity of the wind, and by being able to prove that upon the dates upon which damage is alleged to have been done, the wind was blowing the fume in another direction, many suits have been avoided. If the Mammoth plant is closed it will practically sound the death-



*THE CONCENTRATING PLANT OF THE CANANEA CONSOLIDATED.*

## SAN FRANCISCO.

**Copper** mining and smelting in California is at a low ebb just at present. Nearly 49,000,000 lb. of copper was produced in California in 1910, since which time the Bully Hill mine, with an annual production of about 4,000,000 lb., and the Balaklala mine, with an annual production of 9,000,000 lb., have become idle, as well as many smaller mines. This has resulted from the closing of all but one of the smelters in Shasta county by court orders secured by nearby agriculturists on account of alleged damage by smelter fume. The Mammoth plant of knell of copper smelting in California. Experimental work upon processes not involving smelting is being conducted at the various mines. It has recently been suggested that the Balaklala (which started as the Balaklala Mining Co., was re-organized as the Balaklala Consolidated Copper Co., and becoming bankrupt, was reconstructed as the First National Copper Co.) should engage in the manufacture of sulphuric acid. This hardly seems feasible, as the existing sulphuric acid plants adjacent to San Francisco are more than able to supply the present demand, and it would be necessary first to create a large

new market for the acid. The manufacture of super-phosphate has been suggested, but does not seem to offer much promise as yet.

**Potash.**—A sequel to the recent disagreement between American fertilizer manufacturers and German potash-salt producers is seen in the greatly stimulated interest in sources of supply of potash salts within the United States. Much public interest has been aroused and the United States Geological Survey is taking a prominent part in the movement, both by promptly investigating alleged discoveries, which have so far proved unfounded, and by conducting independent investigations. The most interesting of these is the drilling of deep holes in what was the basin of the prehistoric lake, Lahontan, in southern Nevada. The possibility of the now dry bed of this lake being underlain by saline deposits is regarded as sufficient to justify drilling. A 12 in. hole is now down over 400 ft., but no saline deposits have yet been found. The intention is to continue the hole to 1000 ft. if necessary, and subsequently other holes will be drilled. Lake Bonneville, another prehistoric lake, may also prove of interest in this connection. The criticism has often been levelled at the United States Geological Survey that its investigations too often were in the form of a post-mortem upon an almost worked out deposit, but in this case, at least, the Survey is exhibiting commendable initiative.

**Cripple Creek** is one of the most interesting districts in America, and shares with Western Australia the distinction of possessing deposits of gold ore in the form of tellurides; the two districts, curiously enough, having been discovered almost simultaneously (1891 and 1893, respectively). The gold production of the Cripple Creek district was big for many years and at one time averaged $2,000,000 per month. But during the past five years it has been steadily declining and now amounts to about $1,350,000 per month. The decline is due both to the exhaustion of the richest ore and to the difficulty of working the deep levels on account of water. The Cripple Creek deposits, somewhat like those of the Braden copper mine in Chile, occur in the shattered core of an ancient volcano. This shattered mass of rock forms a sump for the entire area. Numerous adits have been driven to secure drainage, as the workings penetrate to deeper levels. In 1907 the lowest of these, the so-called Roosevelt tunnel, was started, and has been in progress ever since. Some months ago the breast had reached a point at which it might have been expected to develop a large flow, but the results were disappointing. Those in charge of the enterprise persisted, however, and their persistence was finally rewarded, for during the last week of November, the two drifts on the C. K. & N. vein developed a flow of 5500 gal. per min., and the total flow from the adit is now nearly 9000 gal. per min., corresponding to a rapid decrease in the water-level of the district. The Battle mountain mines are being unwatered at the rate of 3·1 in. per day and the Portland has already recovered its 1500-ft. level, while the 1050-ft. level of the Stratton's Independence, flooded since 1907, has also been recovered. Production in the district will be greatly stimulated, and a 'boom' is confidently expected. It therefore seems an unpropitious time for the mill of the U.S. Reduction & Refining Co. to shut-down. This mill has been treating monthly over 13,000 tons of ore, of an average gold content of $21·50 per ton. This will now go to the Golden Cycle plant, which treats 26,000 tons per month, but at an increased treatment charge, the charges for freight and treatment at the Golden Cycle and U. S. plants for ore of this grade being $6·50 and $5·50 per ton respectively. Much of the low-grade ore is now being treated by mills at the mines, the new Portland mill taking 12,000 tons of $3 ore and the Stratton's Independence 10,000 tons of $2·75 ore, other smaller mills contributing. A recent acquisition to the list is the Ajax. This mill has just been completed and its most notable feature is the use of the Clancy process for treating raw telluride ore. This involves the use of calcium cyanamide and the electric current. The process is little understood as yet, and as this is the first instance of its application upon a commercial scale, the results of an extended trial will be awaited with much interest.

**The Macquisten Tube.**—A concentrating device that is attracting attention in the West is the 'tube concentrator,' more often referred to as the Macquisten tube, the invention of a Scotsman of that name. The device has often been described before, but briefly it may be said to consist essentially of a cast-iron tube, about a foot in diameter and provided with corrugations on the inside. This is slightly inclined from the horizontal and revolves at a speed such that the pulp is gently carried up to the water surface, the gangue breaking through and settling in the box at the end while the sulphides float and are

carried away by the water discharge. The action of the tubes is singularly effective, their chief drawback being the low capacity, which is only partly compensated by their low cost per unit. The results obtained are excellent, and the differing degree of 'floatability' of sulphides of different metals renders it possible to make such a separation as pyrite from zinc-blende. The use of the device is spreading, as over 100 of the tubes are in satisfactory use at the Morning mill of the Federal Mining & Smelting Co., at Mullan, Idaho, and a plant of 24 tubes has also been erected at Park City, Utah, to treat the zinc tailing of the Grasselli Chemical Company.

**Copper.**—The great topic of interest in copper circles has been the recent move of the Amalgamated Copper Co. in acquiring control of the Live Oak Development Co. at $30 per share. It is generally understood now that Live Oak, Inspiration, and Miami will eventually be consolidated under one management, and the impression is general that the Amalgamated interests, which have so long pinned their faith to the vein mining of copper ores, have at last unwillingly been convinced of the importance of the low-grade disseminated deposits and have taken this opportunity to secure their position before it was too late. The Live Oak claims to possess 19,000,000 tons of ore averaging 2·11% copper. The consolidated companies would have 65,000,000 tons of ore averaging over 2·1% copper. The ore reserve of the Inspiration on December 1, is given as 30,000,000 tons of 1·95% copper ore. The fifth unit of the Miami concentrator has been started and the Miami production is at the rate of 2,500,000 lb. copper per month. The American Smelting & Refining Co. has taken over the Ray smelter at Hayden, Arizona, and plans to have it in operation early in the year. It therefore behoved the International interests to make a countermove to prevent being outdistanced in blister production. While speaking of copper it should be noted that the Mason Valley smelter at Wabuska, Nevada, is practically completed and is expected to be blown in before the end of 1911. It is expected to have a production of 1,000,000 lb. of copper per month, taking 10,000 tons of custom ore per month from the Nevada-Douglas mine.

**Goldfield, Nevada.**—Early in December the surface plant of the Florence-Goldfield Mining Co. at Goldfield, was entirely destroyed by fire. It is reported that a new mill will be constructed, or a second-hand one procured, and that of the Homestake-King at Rhyolite is under consideration. The Florence mine was discovered in 1903, and, as in the case of the other important mines at Goldfield, the valuable orebodies were uncovered by lessees. Some of the ore mined at first was very rich, a shipment of 37 tons averaging over 53 oz. per ton, and a 1-ton lot 396 oz. per ton. The mine has since been so gouged by lessees that much development work on company account has been necessary.

## MELBOURNE.

**The Year's Progress.**—The end of the year is fast approaching and the condition of mining in Australia can be reviewed. Taken generally it has to be admitted that little or no progress has to be recorded with the industry. This arises from the absence of new discoveries, a story that has been told before. Great hopes existed in respect to Tanami on the borderland of the Northern Territory and West Australia, back in the heart of the dread Never Never country. It is established that a belt of auriferous territory exists there, but the difficulties of reaching the district and the aridity of the huge tract of desert surrounding it have compelled even the hardiest prospectors to abandon the locality. Nowhere in Western Australia has any strike been made to revive the flagging tendencies of the gold-mining industry. This is partly accounted for by the dryness of the back country; still more by the disinclination of capital to help labour at the present time when labour is avowedly out in open warfare against the man with money. In addition the demand for labour everywhere is so great owing to the marvellous prosperity of Australia that men will not risk their lives or spare the time to go in search of fresh fields with the risk of ultimate failure, when high wages and the best of conditions prevail in almost every other industry. The only spot that presents any attraction is an out-of-the-way corner of the Gulf of Carpentaria in the Northern Territory. Thither not long ago journeyed Frank B. Powell to investigate the statement of a couple of prospectors who declared that they had alighted on "a greater than Broken Hill." Mr. Powell's journey was over country only before traversed by pack-horses and an occasional mob of cattle. He went thither in a specially equipped motor-car, and though he failed to endorse the opinion of the prospectors that an Eldorado had been found, he at least could say that the indications justified the expenditure of a fair sum of money to determine whether the huge outcrops deserved

testing on a large scale. Capital in Australia, as pointed out just now, is shy where mining is concerned, and so the appeal for cash had to be made to London which, wherever a decent prospect shows, is not slow to supply funds. Lionel Robinson, Clark & Co., through the firm of E. L. & C. Baillieu, were responsible for engaging British financiers in the venture. Everyone on this side is earnest in wishing the venture success. The district is well watered and fairly well timbered, but labour will have to be allured thither. Consequently all work will be costly. Opinions are divided as to the real merits of the find, the exaggerated descriptions of the prospectors contrasting with Mr. Powell's cautious utterances. The samples of the ore sent show fair-grade galena carrying a small percentage of zinc. The country rock appears to be quartzite but the descriptions are not very definite. Anyway this is the only find in new territory that is attracting attention, though some money is being expended in testing a big copper-bearing formation some distance away from the Pine Creek railway in the Northern Territory, in only partly explored country.

Stepping across the border into Northern Queensland, 500 miles or so, the progress of copper mining is most satisfactory. The two mines to lead the way are still the Hampden and the Mount Elliott. Facts about the latter have reached you long since, how the company has added a little to its reserves of rich ore and substantially to its reserves of low-grade ore, the fact being that the bottom level has failed to furnish any development that should tend to materially enhance the value of the venture. Work at the Hampden mine has disclosed some good-grade ore at depth, though not an appreciable quantity. At the company's Duchess mine, however, the company has done a deal better, for good ore has been proved at the bottom level at over 500 ft.; and it appears to have had the luck to pick up a splendid little pot-boiler in the Trekelano claim, which is opening up a reasonable reserve of high-grade ore.

But the most important matter in connection with the copper mining industry in north-west Queensland is the proposal to amalgamate the Mount Elliott and Hampden companies so as to have one fine company which would dominate the whole of the copper interests of that vast region. W. L. Baillieu is understood to have returned hither with a pocketful of projects, one of the most important being this scheme. As far as can be gathered today the idea is to create a £1,000,000 company in £1 shares, and as the Hampden and the Mount Elliott ore reserves are almost identical and as the aggregate market price of the shares of the two companies is about the same, it has been suggested that each company should take 450,000 shares and let 100,000 remain in reserve. Whether the Mt. Elliott board would listen to this scheme is a point that they alone can decide, but the amalgamation is most desirable, for apart from the metallurgical benefits to be derived from combining the different properties the fused concern would give the group of capitalists dominating the company a complete hold on a vast extent of territory.

**The Mount Lyell** strike is over and the miners are satisfied that the company held the right bower all the time. The directors have certainly agreed to confer with the men and to concede higher wages, but they have not really given way a point. The firmness displayed by Robert Sticht and the backing given to him by the board amazed the union officials, who hitherto have had a good deal of wobbling to help them in their demands made in other quarters for an advance in wages. The company's mines are re-opened but of course when the demand for labour everywhere is so keen, it is hard to reassemble the staff after it has been dispersed to the four quarters of the Commonwealth. It seems to be clear that the Mount Lyell board will have to pass its dividend at the close of the current half-year. At the mine the company has been enabled, owing to developments at the three bottom levels of the North Lyell mine, to report an increased ore reserve. Some of the bornite at 1100 ft. is the richest yet found in the mine. In this respect the North Lyell is one of the geological curiosities of the day, and a treasure trove in addition. Next door to it, the Lyell Blocks company is seeking to discover whether the North Lyell shoot of ore is pitching into it.

**Broken Hill.**—The December dividends provided by the Broken Hill companies already declared amount to £200,000, and when the Sulphide Corporation and Amalgamated Zinc companies announce their disbursements that total will be largely increased. The price of zinc and the satisfactory figure at which lead stands are the factors that enable Broken Hill to declare such a fine set of dividends for the quarter. The South company leads the way with 5s. per share and the North is next with 4s. per share, disbursements never attained before by the two concerns. The shares

of both these mines are largely held in London and the best compliment that can be paid to the stocks from this side is to say that never was a greater mistake made by our holders than in letting the scrip leave Australia. The Sulphide Corporation also is doing exceedingly well financially; so is the Proprietary, which has taken £75,000 to the credit of reserve out of profits within a very short time, besides reverting to 1s. quarterly dividends on a share register of 960,000. The most satisfactory development at the Barrier is still in the British mine where the 900-ft. level on the new shoot

of ore is opening out splendidly. The change in the fortunes of this property has led to extensive buying on this side of the world. Our regret is that we cannot get the management here, for the conservatism of the London board in respect to permitting the publication of plans and assays on this side is not at all appreciated by local holders. Why there should be any mystery is far more than the average Australian shareholder can understand.

## TORONTO.

**Porcupine.**—The construction of the extension of the Porcupine branch of the Temiskaming and Northern Ontario Railway to Pearl lake has been actively pushed, and the work is expected to be completed early in January. The opening of this line for traffic will give facilities of transport to about sixteen working mines in the Pearl lake area.

Owing to unexpected difficulties in the construction of the steel framework of the stamp-mill of the Dome, it is not likely to be in operation much before the spring. In all 42 stamps will be installed. The work of sinking shafts is proceeding slowly, present efforts being mainly directed towards measuring a body of milling ore in the ankerite along the main ridge. In addition to the two drills that have been in operation for three months, two more are now ready for work. At the Dome Extension, the main shaft has been sunk and timbered to the 200-ft. level, and an additional 20 ft. sunk for a sump. Cross-cutting has been started at the 100 and 200-ft. levels northward towards the mineralized zone, in which six veins are known to occur. Discouraging reports from the Rea recently caused a depression in the stock. An official statement was issued admitting that the assays obtained in the cross-cut at the 300-ft. level had proved disappointing, and stating that final tests would not be made until the company's assay and testing plant had been installed. Oscar Bergstrom, the new manager, has decided to sink the shaft to the 400-ft. level. The company has sufficient funds to continue development for some months. The lowest depth so far reached in the camp has been attained at the Pearl Lake property, where the diamond drills cut the mineralized zone at 1154 ft., and were put down through it to 1218 ft. Six samples yielded values ranging from 40 c. to $20. The Davidson property, operated by the Crown Chartered, is showing up well. The hanging-wall of the vein has been cut 137 ft. from the shaft at the 800-ft. level, showing a schist zone 90 ft. wide. Drifts from the cross-cut at the same level show a continuous orebody 110 ft. in length. The vein on which the shaft was sunk has been developed for 500 ft. on the surface, showing an average width of 20 to 30 ft. Assays show a satisfactory gold content. At the Hollinger the extension of the main vein has been picked up at the 200-ft. level.

It had previously been lost for several hundred feet. The ore is stated to be rich. Scheelite has been found at the 100-ft. level. The West Dome mine has cut a bonanza sulphide vein, which shows 200 ft. of mineralized matter between the walls. At the McIntyre mine the foundations for the 10-stamp mill are being laid. Good ore has been found in a cross-cut under Pearl lake. A number of promising veins have been uncovered on the La Palme property, where free gold has been taken from shaft No. 2 at a depth of 25 ft. Ralph Anderson has resigned as manager of the Apex, his place being taken by John Wilson. An ore-shoot is being developed. The Vipond has cut No. 2 and 3 veins at the 200-ft. level, the ore exposed on the 100-ft. level being apparently continuous. The compressor plant has been installed. In sinking at the east end of Pearl lake, the Plenaurum has struck a 4-ft. quartz vein rich in visible gold. The Eldorado has let a contract for sinking a shaft and the work will be commenced immediately. The Achilles, to the North of the Scottish Ontario, is installing a plant. A. G. Burroughs, of the Ontario Bureau of Mines, has found scheelite near one of the paystreaks in the Jupiter mine, and large quantities of this mineral were discovered on the Jupiter dump.

**Cobalt.**—The year's production of silver in the Cobalt district will show a handsome increase over the output of 1910, shipments having been well maintained latterly. The vexed question of what disposition the La Rose Consolidated will make of its steadily increasing surplus, now amounting to upwards of $1,500,000, excites much discussion. The majority of the stockholders are apparently anxious for a substantial increase in the present modest dividend rate of 2% per quarter, as many of them bought when the stock was double its present figure, but the directors have so far proved inflexible on that point. It is now proposed to invest some of the cash reserve in buying a Porcupine gold property. This is strongly opposed by many shareholders, who dispute the right of the management to engage in speculations with their money. A similar transaction by the Temiskaming has aroused much opposition. The latter company appears to have got to the bottom of its ore reserves on the Temiskaming location proper, but it is hoped that the ore goes deeper on the adjoining Gans lot. Stoping is being done at the 200 and 250-ft. levels and much high-grade ore is being extracted from the lower levels. The aerial tramway between the Nova Scotia mill and the Crown Reserve ships about 75 tons and the Kerr Lake tons per day to the Nova Scotia mill f treatment, and the Drummond has contract to send 35 tons a day for milling. The annu statement of the Coniagas shows ore a cash in hand to the amount of $920,00 During the year, 169 tons of ore was crush daily, and 3,789,274 oz. silver shipped, the notably low cost of 8·8c. per oz., as co pared with 13·28 c. the previous year. T engineer estimates that the ore reserve co tains 12,516,000 oz. silver. The smelter Thorold treated 2860 tons of ore and shipp 5,642,803 oz. silver. At the Nipissing a ne stope has been started at shaft No. 64, on t third level, on an ore-shoot 90 ft. in leng and 12 in. wide, reported to assay 5000 Stoping at the Kendall vein shows 2 to in. of 2500-oz. ore, but the stope is getti shorter. At the Meyer shaft, in a rise fr vein 73, the vein averaged 4 in. of 1800- ore for 36 ft., where it faulted. The ne stope at the 200-ft. level of vein 100 averag 3000-oz. ore over a width of 2 to 3 in., t ore-shoot being 140 ft. long. A stringer fr the main vein contains 2 in. of 2500-oz. o The Green Meehan, an old-time produc has shipped 30 tons of low-grade ore to De ver. Sir Henry Pellatt has acquired t Dominion Silver in North Cobalt on a months' option.

**The Elk Lake and Gowganda** silv areas are in a more favourable condition, d to the stimulus of a promise, made just bef the recent provincial elections by the Onta Government, that a branch of the Temiska ing & Northern Ontario Railway will be co structed early in the year. The exact rou has not been officially decided, but it will e tend from some point on the main line as f as Elk Lake at least. This will enable ma properties, which it was found impossible work economically by reason of transp difficulties and high freights on ore shipmen

## JOHANNESBURG.

**Changes in the Groups.**—There a again several noteworthy changes in the pe sonnel of the various managements. Sydn Penlerick leaves the East Rand Proprietar where he held the position of general manage his successor being W. T. Anderson, former of the Rand Mines. Mr. Anderson will associated with H. Ross Skinner, gener manager of the Durban Roodepoort Go Mining Co., who has been appointed supe intendent engineer to the East Rand. Madew has replaced H. Stuart Martin as co

sulting engineer to the City Deep. W. E. C. Mitchell leaves the Ferreira Deep, his position as manager being taken by F. J. Trump, lately inspector of mines in South Wales, who has only quite recently come out to this country.

**Ferreira Deep.**—The November figures for the various mines have just been published and contain the following note on the Ferreira Deep: "The reduced profit is due to lower tonnage crushed, chiefly owing to labour stringency and to partial caving in of several of the rich stopes, thereby rendering these stopes unproductive while they are again made safe. None of this ground is permanently lost. Reversion to recent profits is expected in January." The tonnage milled in November was 30,020 tons, against 32,600 tons milled in October, the profit for November being £32,789 against £37,445 for October, or a drop in profit of £4656. The mine is equipped with 160 stamps and 4 tube-mills, making it possible to crush about 35,000 tons per month. For the year 1910 361,340 tons were crushed, the assay-value of the ore before crushing being 11·662 dwt. At the end of 1910 the ore reserve was as follows: 1,779,328 tons of profitable ore assaying 9·6 dwt., and 124,179 tons of material assaying 2·2 dwt., making a total of 1,903,507 tons averaging 9·1 dwt. The percentage of waste sorted for 1910 was 20·3. The working profit for the year 1910 was £502,028 and for the first 9 months of 1911 the estimated working profit was £305,556, which shows a considerable decrease over the previous year's result. The mine should be doing better. There is certainly something wrong with the way in which work has been carried out underground if "several of the richer stopes" are allowed to cave in. It is true, within the last few years the mine has been troubled by the continued gradual settlement of the ground all over the area under which its workings lie, the original movement being caused by the removal of ore in the Ferreira workings, from the outcrop to the north boundary of the Ferreira Deep; but had the necessary precautions been taken in time to support the depleted stopes, the mine should by now have been in good condition underground and there would then be no trouble from caving of stopes. The shafts also have caused anxiety and the sand-filling of large areas is in progress, to make pillars in place of those (of solid ground) that have been stoped or have proved too small. The change in management may yield better results.

*ROBINSON DEEP, one of the Mines that has increased its dividends in 1911.*

**Contract System.**—The Mine Managers' Association has recently been discussing this question and it would seem that for several reasons the contract system will shortly be discarded, in favour of the day's-pay plus

bonus system of payment for the breaking of ground. The general feeling is that it is time that rates of pay were standardized. At present each union recognizes different rates for the same class of work. The variation in rates of pay is wide, the most marked being in the earnings of miners working on contract, who make anything up to about £5 per shift. Such excessive variations are in most cases unfair, as they are not due so much to the difference between good and bad miners, as to the element of luck. On some mines the policy of the management is to allow contractors to make good pay in the hope of attracting the best class of workers. Under the present contract system if a miner becomes in debt under his contract, it is usual for him to have his wages made up to the day's-pay standard of about £1 per shift. The bad miner is therefore not encouraged to work any better and the whole purpose of the contract system fails in such cases. Furthermore, the possibility of good miners making good pay on contract induces many men who would be of more use as shift-bosses, to continue working as contractors, making money with less trouble and responsibility than they otherwise would on the underground supervising staff. Since the new mines regulations have come into force, the day's-pay plus bonus system has proved useful as a means of overcoming the difficulties and restrictions imposed on the mine managements by the section of the new regulation referring to 'Underground Contract Work.' The adoption of this method therefore will have the effect of levelling down the rates of pay for good and bad work, and the good miners will either decline to the level of the poorer class of workers or leave the country for other mining districts, where better pay can be made. The day's-pay scheme will be to the disadvantage of the deep-level mines and the mines farthest from Johannesburg. Work underground on the outcrop mine is much preferred by miners to work on the deep levels and, if the same rates of pay obtain, the deep-level mines will be greatly handicapped by their inability to obtain a good class of white labour underground. The same applies to mines on the Central Rand around Johannesburg, which are preferred, by miners, to the outside mines.

**The Death Rate** from accidents and phthisis is the chief topic of the moment. In conjunction with the stir caused by the new mining regulations, it is interesting to note the death-rate from accidents, so that at some future date comparisons may be made on this subject, to indicate the effects of t 8-hours working day and other new rul For this reason a paper entitled 'Acciden in Transvaal Mines' by J. Chilton, read at t November meeting of the Chemical, Met lurgical & Mining Society, is noteworth Mr. Chilton at the outset states that "tod we hold the ignoble distinction of possessi the highest accident-rate of any mining d trict in the world." The accident-rate 1910 was 10·23 per 1000 employees. compared with an average death-rate of 1 in England, the Transvaal figure is 4·29 1000 per annum. The increase in the nu ber of accidents classed as "owing to dang inherent to the work itself" is 23·26%, sin 1903. It is notable that generally speaki the deep-level mines show the highest dea rates. This increase calls for serious thoug Mr. Chilton advances several reasons for t increasing death-rate in our deep-level min but he appears to have missed the point. H states that "miners assert that the increase due to the rush to keep the mill going." T miners are right; that is one reason, a another is that of cost. The deep-levels co stitute our newest mines. Consequently t hanging-wall appears sound, as compared w that of the old mines; to the average mi manager it goes against the grain in su cases to increase his working cost by sy tematic timbering or rock-walling. On t oldest mines, in which the hanging-wall bad throughout, systematic timbering or roc walling has to be adopted, with the result th these mines show a lower accident death-ra than the newest mines. A further reason the increase in the death-rate in deep-le mines is the shortage of native labour. the labour supply gradually decreases and t need to accelerate production becomes pre ing, it becomes inadvisable to cut the wag of those engaged in stoping operations. Her this class of labour is better paid than th devoted to timbering and repair work. T present high death-rate from accidents und ground can be reduced by the enforceme by law, of systematic timbering and roc walling, and by embodying in the regulatio a clause to the effect that every working pla must be inspected by a special gang of mine working between the ordinary shifts and porting the results of their examinations to responsible person—for example a shift-bo —who shall then and only then allow nativ or other employees to pass beyond fixed s tions to their working places. This cou easily be done on the same lines as the fi

men or deputy's work in the English collieries.

**East Rand Proprietary.**—It may be a pity to belabour any single episode, yet by doing so a more thorough grasp of all the points at issue can be obtained. The result of the inquiry into the E.R.P.M. catastrophe is now generally known. It is worth while to note what effects the terrific rush to obtain as much ore as possible, and to pass it through the necessary treatment, has had on this mining enterprise. The pace that was initially set at too high a rate, by grave miscalculations in the ore reserve and plant capacity, has been maintained as long as possible, to the detriment of the underground department, Many possible reasons for the supposed loss of gold in the reduction works have been suggested by people of a metallurgical turn of mind. Many of whom would have done better to await results, rather than jump at conclusions. The effect which the high speed of working has had on the reduction work, such as wastage of zinc and ill condition of amalgamating plates, is now generally understood. On the other hand, the mistakes made underground are in most cases disregarded, chiefly because they, like "the sins of the fathers," are felt most acutely at a later date. At many mines on the Rand the amount of ore capable of being treated in the reduction works, in any given time, is incapable of being supplied by the underground departments, if such consideration as maximum of safety, economical management, and efficient working are given adequate thought. In the case of the E.R.P.M., economy and efficiency have been sacrificed to the frenzied rush to maintain production. The cry was for ore at any price, 'ore' meaning, under such conditions, conglomerate carrying gold in profitable proportion, but diluted with as much unprofitable quartzite as the profitable portion would stand without the fall in grade becoming too pronounced. The results obtained in 1909 were as follows:

| | Average for 1909 | Results for October 1911 |
|---|---|---|
| Profit for month | £104,921 | £50,000 |
| Tons milled per month | 152,523 | 169,256 |
| Revenue per ton milled | 29s. 2d. | 24s. 11d. |
| Cost per ton milled | 15s. 5d. | 19s. 4d. |
| Profit per ton milled | 13s. 9d. | 5s. 11d. |

The above figures speak for themselves. Apart from the decreased profit, the effect of this rush to obtain ore has yet to be met in many ways. The nearer the shaft the more quickly the ore can be extracted when everything is being rushed, as less time is required to get the broken ore to the shaft. In a case of this sort, the question of leaving shaft-pillars becomes a secondary consideration; shafts are in consequence weakened and such weakness becomes more pronounced as time goes on. Blocks of ground presenting more than average difficulties in working, due to faults or what not, are avoided; in course of time the hanging-wall caves around such blocks and in future extra expense will be incurred in re-opening them for working. The proper rate of development required to open up fresh reserves of ore, to replace that being worked out, also becomes a secondary consideration, and in the long run this also has to be paid for. The shafts cannot be kept in proper repair. It is also quicker to replace underground machinery, such as machine-drills, by new machines, when there is not time to spare to repair old ones; in consequence, many machines will be scrapped before being worn out. These are among the results that the directors of the East Rand Proprietary Mines have brought upon themselves by sheer weakness in failing to face a difficulty and in refusing to admit their inability to carry out an ambitious programme.

## NEW YORK.

**The Stock Market** continues its upward course under the stimulus of increasing commercial activity. The impending steel suit appears to have been forgotten by the general public. The meat trust is at last firmly caught in the toils, and the 'money trust' is threatened with chastisement. The steel industry is booming, and all the idle furnaces are being overhauled and put into condition for immediate use. As compared with a month ago, Amalgamated has risen 2 points; Chino, 2¼; Miami, 1¼; Ray, 3; and Utah Copper, 4¼. The United States Steel Corporation's common stock, in the face of the Government's suit for dissolution, has gained 2⅜ and the preferred 1⅝ as compared with a month ago. Improvement in the steel business is also reflected by the Republic Iron and Steel shares, which have gained 2⅞ during the month.

**Tariff Reform.**—The first session of the sixty-second Congress opened in December, with the Democrats in control of both houses for the first time in many years. The most interesting episode as yet is the receipt of the long expected report of the Tariff Board on the woollen schedule of the present tariff act. This is to be followed by similar reports on cotton, iron and steel, and chemi-

cals. The Tariff Board, it should be explained, is a new departure in American tariff legislation, and this is its first official utterance. The board is responsible directly to the President and acts only in an advisory capacity. The creation of the board was deplored by many firm admirers of the Constitution, as tending to shift the prerogative of initiating revenue measures from the House of Representatives, where it is vested, to the President. Congress has, however, displayed no great resentment, in fact, appears willing to profit by the scientific and painstaking investigations now being conducted by the board. The present investigation was undertaken for the purpose of ascertaining the difference in the cost of producing a given woollen commodity in the United States and abroad. After outlining the methods adopted by the board, and explaining the necessity for a large amount of estimating and approximating, the report does maintain, however, that in regard to comparative 'costings,' the real nucleus of its labours, its conclusions are reasonably accurate. The full text of the report is not yet available, but the published summaries indicate conclusions which must be something of a shock to the beneficiaries of the present iniquitous tariff act, at whose importunity the board was created. The two most revolutionary statements are, first, that the difference in cost between the United States and Europe is by no means so great as we have been taught to believe, certainly not enough to justify the present imposts; and second, that the cheaper the goods the larger the ratio of labour to the total cost. The report even goes so far into unorthodoxy as to attribute the lower cost of some goods made in Europe to superior business sagacity or mechanical skill. In all this, of course, there is nothing surprising to those who have studied the matter with unbiased minds; in fact, it has been notorious that in the highly protected steel and cotton industries, the poorest paid labour has habitually been employed; but coming as a confession from the party which has stood for years committed to the policy of government subsidies to favoured industries, the report is a refreshing sign of returning righteousness, to say the least. Four different cabals are already at work devising as many new woollen schedules, each of which is to be moulded with equal exactness to the specifications of the Tariff Board. The Democratic members threaten to go ahead with their plan for reducing the duty on steel without waiting for the board's next report. Even though the wisdom or necessi for maintaining any relation whatever betwee duties and comparative costs be denied, would seem unwise, while revising the tari not to take advantage of the data so diligent collected by the board, if only as collater evidence.

**The Copper Market** is in a conditio analagous to that existing in 1907, and demo strates again that American consumers of co per seem to possess less intelligence than tho engaged in almost any other line of business. 1907, after sagaciously staying out of a risi market, many consumers rushed in and fill their storehouses with millions of pounds of co per at 26 cents; in some cases, when the ti soon after turned the other way, these sar consumers had to call on the producers for he to carry their stocks. For the last year two, with copper at the minimum price which many established mines could possib afford to sell it, the consumers have, with t same sagacity, refrained from laying in stoc and have bought their supplies at bargain sa as needed. As on previous occasions, Europe buyers have been first to recognize the tr situation, and have been buying heavily in t United States. The London speculators we next attracted, and their operations have be partly responsible for the recent advance 14 cents. A few American buyers have n begun to lay in stocks which they might ha had for 12 cents a few months ago, but it mains to be seen how high the price will ha to go before the great body of American co sumers can be persuaded to buy for futu needs. Those closest to the market pred confidently that for a long time now the pr will range between 14 and 15 cents. T climax is due to arrive in about 1915, which time the ever growing consumption w have absorbed the new supplies which are j now coming into the market from the porphy operations. That old bugbear of the cop market, the so-called 'concealed stocks' Europe, is now laid to rest. The latest s tistics itemize the holdings at Amsterdam a Rotterdam, information which has heretof been withheld, showing that the amounts copper stored in those cities were not a mat for serious concern. The unsettledness t usually attends a presidential year has larg been discounted already in the case of 19 and the coming year will probably see no i portant diminution in copper-consuming dustries, whence a steady market may be ticipated. Production likewise will proba record its customary ratio of increase.

# METAL MARKETS

## COPPER.

Average prices of cash standard copper:

| Dec. 1911. | Nov. 1911. | Dec. 1910. |
|---|---|---|
| £61. 3s. 11d. | £57. 8s. 4d. | £56. 18s. 2d. |

The past month has witnessed a renewal of speculative activity. The continued decrease in stocks during recent months has been followed by a fresh record, by the startling reduction of 13,517 tons in the world's stocks for November. Such favourable figures, in spite of the restraining effect of financial, political, and economic disturbances, have awakened some anxiety among consumers, and a general buying movement, covering the first three months of 1912, has exhausted the capacities of most of the leading American refineries. Electrolytic copper has consequently risen from 13¾ c. to 14⅜ c. in New York. The attention of speculators has been attracted at the same time, and prices have risen from £59. 13s. 9d. to £65 for three months copper. Under the influence of profit taking, prices fell again to £63. 5s., but the tone of the market is healthy and trading is large. The close of the month saw good buying once more at £63. 15s. The gigantic trade with consumers attests to considerable industrial prosperity, and all appearances point to prolonged activity. Electric traction seems to afford almost boundless possibilities, and the boom in shipping has filled the yards with work for many months ahead. In America the position is still somewhat obscure, but the latest advices are optimistic and the steel trade is improving. The stocks (considerably less than two months consumption) are uncomfortably low, and indications point to a further reduction in the near future.

## TIN.

Average prices of cash Straits:

| Dec. 1911. | Nov. 1911. | Dec. 1910. |
|---|---|---|
| £203. 7s. 2d. | £194. 19s. 4d. | £173. 17s. 3d. |

The tin market has exhibited great sensitiveness, although fluctuations have been rather less severe than usual. There has been increased activity in dealings for Standard tin for three months delivery, and prices advanced to £194. 10s. upon good purchases by leading dealers. Straits for December and January dates advanced to £208 for spot and £201. 15s. for the end of January. From this level prices declined, owing to realizations by stale bulls and ready selling by Eastern houses; brokers appeared as large sellers for January dates and accepted low bids, cash tin being done at £199. 10s., and three months at £191. 15s. About the middle of the month, however, a sudden demand sprang up from America for Straits, and roused the market from its lethargic condition. Dealers, who had previously sold freely in America, absorbed all offering in the East and also appeared as buyers on our market. Under this stimulus £206 was reached for cash Straits, but Standard never rose above £193. 10s. After a temporary reaction to £204 cash and £190. 5s. for three months, prices once more rose toward the end of the month, to £207 for Straits cash, and £192 Standard three months, finally closing with a weak tone at £2 under.

## SPELTER.

Average prices of good ordinary brands:

| Dec. 1911. | Nov. 1911. | Dec. 1910. |
|---|---|---|
| £26. 13s. 7d. | £26. 13s. 2d. | £23. 17s. 8d. |

Business in this metal is not brisk, although galvanizers are reported to be busy and have taken orders well into the new year. Many of them are full of work until February. They are, however, unwilling to agree to the terms which the spelter syndicate desires to impose, although it does not appear that they can buy from outside.

## LEAD.

Average prices of soft foreign:

| Dec. 1911. | Nov. 1911. | Dec. 1910. |
|---|---|---|
| £15. 13s. 4d. | £15. 15s. 5d. | £13. 3s. 9d. |

Lead has been affected by the slack trade which is usually prevalent in December, and consumers appear to take little interest in purchases. Speculators, however, are impressed by the activity of the electrical trade and have purchased freely up to May delivery, paying as much as £15. 17s. 6d. Supplies are by no means plentiful and difficulties of shipment both from Spain and America are increasing.

## OTHER METALS AND MINERALS.

Prices quoted on January 10:

SILVER.—25⅝d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£56 per ton.

NICKEL.—£170 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£28 per ton.

QUICKSILVER.—£8. 2s. 6d. per flask.

MANGANESE ORE.—8d. to 9½d. per unit (1%).

IRON ORE.—Cumberland hematite 23s. 6d. per ton at mine. Spanish 21s. 6d. delivered.

PIG IRON.—Cleveland 50s. 9d. per ton. Hematite 64s. per ton.

WOLFRAM ORE—30s. per unit (1%).

# PERSONAL

W. T. ANDERSON has been appointed general manager of the East Rand Proprietary.

J. N. F. ARMSTRONG, formerly at Broken Hill, and lately at Great Cobar, is in London.

WILLIAM BACH has returned from Cuba.

H. C. BEHR returned to South Africa on December 17.

J. MCINTOSH BELL spent the Christmas holidays in Canada.

CHARLES R. H. BLYTH is chief engineer to the Mazapil Copper Co., in Zacatecas, Mexico.

C. P. BOONE is on his way to India, for Charles Butters & Co.

E. H. BRANDT has retired from the firm of Bainbridge, Seymour & Co.

HENRY BRELICH has returned from Mexico.

GERALD M. BROWNE is on his way to examine the Frontenac mine, in Colorado.

E. J. CARLYLE has left the Kyshtim Corporation and is going to Arizona.

R. DAVEY is at Surbiton, having returned from Bogoslovsk, Russia. He will return thither in February.

ARTHUR DICKINSON sailed for Daylesford, Victoria, on December 29 to be absent three months.

ARCHIBALD A. C. DICKSON has moved his office from Rejauli to Kodarma, on the East India Railway.

FRANCIS DRAKE has returned to London from San Francisco.

H. S. DRINKER is returning from Japan by way of Hong Kong and India.

S. C. DYER is returning to Bulawayo, Rhodesia, on January 13.

F. Y. GARNETT is home for a holiday from the Prestea mine, West Africa.

F. LYNWOOD GARRISON is in Arizona.

H. W. GEPP is here from Broken Hill and will investigate European zinc metallurgy.

G. F. HEATH has gone to Swaziland.

ROBERT HENDERSON has returned to England after being 22 years on the Rand.

Sir THOMAS HOLLAND is in India on a professional visit.

J. IRVINE JAMESON has been appointed manager of the Leeuwport tin mine.

R. R. JOHNSON is home from Rhodesia.

W. M. KNOX is on his way to San Francisco, leaving that port on February 20 for Vladivostok.

H. A. LEWIS has arrived from Cobalt.

D. G. LUMSDEN has been appointed secretary to the Mount Lyell Mining & Railway Co.

J. MALCOLM MACLAREN is in Alaska.

T. R. MARSHALL has returned to Mexico.

GEORGE C. MASTER is consulting engineer to an Anglo-Mexican syndicate at Pachuca.

WILLIAM H. MERRETT has been promoted to the rank of professor in the Royal School of Mines.

G. H. MILTON has gone to Nigeria.

DEANE P. MITCHELL has returned to London from New York.

GEORGE V. MICHELL has gone to Northern Nigeria.

JAMES MORRIS, manager of the City Deep, has resigned.

A. LEGGAT NEALE, lately mine manager at Pilgrim's Rest, is now farming in the Orange Free State.

ALGERNON NOBLE will be near Tashkent, in Russian Turkestan, for three months.

H. F. OLDS is at Hartley, Rhodesia.

THOMAS PASCOE will be in Ontario and British Columbia for the next eight months.

H. G. PAYNE is visiting the Transvaal and Rhodesia.

A. L. QUENEAU is here from Philadelphia.

R. J. D. RICHARDSON, manager of the Bibiani mine, West Africa, is expected in London early in March.

E. J. RICHES has returned to England after nine months prospecting in Asia Minor.

F. PERCY ROLFE is now assistant manager of the New Primrose mine at Johannesburg.

HOWARD D. SMITH has arrived from San Francisco.

W. H. STORMS has been appointed State Mineralogist for California.

W. H. TREWARTHA-JAMES has resigned as manager of the Tyee Copper company and has returned to London.

SCOTT TURNER has accepted a post in Spitzbergen, in charge of productive coal mines.

J. A. VAUGHAN has returned to Johannesburg.

MORTON WEBBER sailed for New York on December 30.

G. H. WINSTANLEY has been appointed to the newly created post of inspector of mining schools in the United Kingdom.

S. W. MUDD, PHILIP WISEMAN, W. S. MOLSE, and C. F. GALAN are travelling to London by way of Korea and Siberia.

# TENDENCIES IN CYANIDATION

By A. W. ALLEN.

A REVIEW of old methods discarded and new ones adopted in milling and cyanide work draws attention to the general trend of modern treatment, and the preference that is being shown for continuous, rather than intermittent, systems. It may even be said that, in sliming practice, the evolution of the process is tending toward an ideal system in which the slimed ore, from the time it leaves the grinding plant, remains in perpetual motion in a definite direction until, its value being removed, it is itself discharged as residue.

In the earlier amalgamation system, in which pans of light design figured prominently, intermittent charges of ore were handled and, after grinding and amalgamation was completed, the contents were transferred and a fresh charge introduced. This method was improved and a system of continuity in grinding took its place, the crushed ore being delivered to the pan, either centrally or otherwise, and the discharge of the ground material occurred simultaneously. The change from the intermittent to the continuous system had far-reaching effects since it exposed the defects in the design of the early types of pans, and the small amount of ore they could handle for the power expended. Improvements soon resulted. Heavier shoes and dies were used, and their area and number increased. Compensating weights were designed and adopted to allow for the loss of weight due to the wear of the shoes, and critical points as regards speed of pan and moisture of feed were ascertained. The continuous system became firmly established and the degree of success attending the many improvements resulting from its introduction may be gauged by the regularity of operation of the pan-grinding system at Kalgoorlie, and elsewhere, for so many years.

Tube-mills were introduced for re-grinding gold ore at a time when continuous sliming was in vogue, but their operation could hardly be termed continuous until the perfection of method allowed the introduction of the grinding medium into the mill without shutting-down. This can now be done by means of a spiral either on the feed or in the discharge end of the mill; the pebbles, in some cases, being introduced automatically.

My first experience in slime settlement was with a system of vats that were not at all unlike what are now known as Dorr thickeners, but with bottoms sloping slightly to a central discharge. The pulp was run in series through a number of these, being delivered centrally in each case, the overflow being distributed by means of an annular ring at the edges of the vat. As soon as one of these was filled with slime the stream of pulp was diverted and the contents were allowed to settle. After a time the clear water was siphoned off, joining the overflow from the last vat, and a slowly moving agitator, at the end of a square vertical shaft and driven by a crown-wheel through which the shaft was free to move, was gradually lowered into the slime until within a few inches from the bottom. The discharge gate was then opened and the thick pulp was then shovelled into a vortex-mixer to be thinned with strong cyanide solution, preparatory to transference to the agitator-vats. This method, by which a pulp of almost any consistency could be obtained, was really an improvement over spitzkasten settlers, since continuous attention was not necessary. The capacity of the vats was low because a quarter of them were always out of commission as settlers, and either being decanted or discharged. The continuous adaption of this method is seen in the Dorr thickener, in which the pulp is delivered into the vats in the same way, but the discharge can be drawn continuously from the bottom of a consistence to suit requirements, the settlement of the slime being practically unaffected by the slow motion of the plough at the bottom of the vat. Modifications may be adopted in the design of the plough but the principle underlying the method is not likely to be improved.

The intermittent system of agitation, in which the pulp was in turn delivered into the vat, agitated, and then discharged, is now being replaced by a continuous method that has brought the Pachuca system ahead of any of the others. By the adoption of this method, and using normally thick pulp, a smaller number of vats is necessary, since no time is lost in either filling or emptying. Additional advantages also accrue from the fact that the agitated pulp is delivered at, practically, the intake level instead of, as in some cases, 40 feet below it; and no attention is required in regulating the air supply so long as the latter remains constant.

The starting of the Ridgeway plant at the

Great Boulder mine seemed to be the solution of the problem of cheap and continuous slime-treatment, and it gave me an opportunity of satisfying myself as to the almost perfect displacement of dissolved metal by the wash. Indeed, from a metallurgical standpoint, the system seemed to be almost ideal, the extraction approaching a maximum and the cost of treatment being exceptionally low. Power consumption was below that of any other system, the thinness of the cake requiring the lowest vacuum both for formation and wash. From the mechanical point of view, however, the machine was of too complicated a nature to be widely adopted, so that metallurgists are still seeking a cheap system of continuous and satisfactory filtration embodied in a machine of simple design. There are numerous continuous de-watering machines, but filtration implies a final displacement of practically the whole of the dissolved metals and this cannot be accomplished in any vacuum machine that does not arrange for the complete submergence of the slime-cake in the wash-solution.

A continuous method of treatment by gradual displacement of metals in solution in Pachuca agitators has been suggested, but the idea has gained no ground since the system possesses all the disadvantages of decantation, a process which, besides involving the handling of large quantities of weakened solution, cannot be successfully applied other than in exceptional cases and with actual extractions below those obtainable from any of the more inferior systems of vacuum filtration.

The precipitation of the contained metals from the solution has always been a continuous process, but it remained for C. W. Merrill to systematize the various operations involved and to arrange a method of recovery that almost eliminates labour and delivers the precipitate, as formed, into the filter-press, which acts as a safe to be opened when required; and makes possible the entire realization of precipitated gold or silver, at any time.

In every case the adoption of the continuous method in place of the intermittent has resulted in higher efficiency and a greater independence from the ill effects of inefficient labour, enabling the few skilled operators to take the place of the many unskilled.

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**Kent Coal** is to be on the market within the first half of the year 1912. The Kent Collieries company, working between Folkestone and Dover, has already raised several hundred tons from the seam at 1274 ft.

## Wolfram Mining in Australia.

A short time ago we referred to the new venture of the Broken Hill Block 14 company in connection with a wolfram mine in the northern part of New South Wales. Further information as to the nature of this deposit and of the method of mining and dressing is now to hand. The mine is at Torrington in the northern part of the granite table-land known as New England. The district has been an important alluvial tin producer. Many lodes carrying tin, wolfram, and bismuth have also been found, but hitherto the operations have been precarious. The only exception is the mine now described, variously known as the Fielder's Hill or the Bismuth, and the orebody has warranted the erection of a stamp-mill and concentrator. Over an area of three or four square miles large outcrops of greisen are found, associated with dikes of rhyolite. Along the contact of the dikes and greisen, and in both rocks, small quartz veins are found that are rich in wolfram. The quartz veins are less plentiful in the rhyolite than in the greisen, and there is no wolfram in the rhyolite outside the lodes; on the other hand the greisen contains innumerable cracks and joints which carry that mineral, and near the dikes and veins and for a considerable distance therefrom the mica has been entirely removed and replaced by quartz, giving the rock the appearance of coarse grained loaf-sugar. Wherever this silicification has taken place wolfram is found in small crystals or groups of crystals. The quantity of wolfram present seems to vary with the silicification, so that the wolfram-bearing quartzose-rock dies away imperceptibly into the unchanged greisen, free from the mineral. There are evidently large bodies of this altered greisen, and their limits will be decided by the price of wolfram and the expenses of mining. At Fielder's Hill the quartzose greisen is greatly developed, being 90 ft. thick, and of much greater width, and containing innumerable joints which carry wolfram, as well as many rich veins of bismuth and wolfram. The ore is quarried by an open-cut which just now is about 60 ft. deep by 200 feet square. The whole of the rock goes to the mill. It is understood that, before purchasing the property, the Block 14 company tested these orebodies outside the open-cut by means of diamond drill-holes. The ore is easily crushed and concentrated. The mill contains 10 stamps, Wilfley and Card tables, and buddles. The new owners will probably erect a new plant.

# GOLD DREDGING IN ALASKA AND THE YUKON

By CHARLES JANIN.

THE first dredge to operate on the Seward peninsula was the old Wisconsin, which was put to work on the Snake river, at Nome, in 1899, and operated during 1900. Since that time dredges, steam-shovels, hydraulic plants, hydraulic and bucket-elevators, and bucket-scrapers have been more or less successfully operated in various parts of Alaska. While numerous failures marked many of the earlier dredge installations, dredging at the present time plays an important part in the far North. The largest enterprises in this northern region are in the Klondyke district, though the greatest number of dredges are on the Seward peninsula. Some dredges are also operating in the Forty-Mile district, both on Alaskan and Canadian territory, and dredges are reported as operating in the Fairbanks district during 1911.

In 1910 sixteen dredges operated on the Seward peninsula during the season and, according to an estimate of the Geological Survey, these handled between 1,200,000 and 1,500,000 cu. yd. gravel, having an estimated value of $800,000. The gold produced by

*MAP OF ALASKA AND PART OF THE YUKON.*

dredges in 1911, on the Peninsula, may be roughly estimated for the purpose of this article at $1,400,000. During the year there were 22 dredges at work, with buckets varying in capacity from 2½ to 9 cu. ft. Buckets of from 2½ to 3½ cu. ft. predominate. Many of the companies had a most successful season. In the Solomon river district there are 7 plants in operation. The Three Friends

dredge, which has recently been taken over by another company, has been 7 years in commission. This dredge is equipped with buckets of 5 cu. ft. capacity. It is reported that over 300,000 cu. yd. was dug to an average depth of 7 ft. and the total cost (including winter charges) is about 18 cents per yard. The new company intends to build a plant to generate electric power, using crude oil as fuel, and expects greatly to reduce the cost of operations. The cost of the power-plant will be between $80,000 and $100,000.

In the operation of dredges in the far North, the fuel problem is a matter of considerable importance. Electricity is, of course, the most satisfactory form of power, but it is not often available, and when a company is operating only one dredge, the installation of a plant to generate electricity is rarely feasible. The use of the gas-engine, of recent years, has demonstrated that a great saving can be made in the cost of fuel, as against the burning of coal or wood, in the Alaskan region.

The following facts, confirming this conclusion, will be pertinent:

The Three Friends dredge is equipped with simple single-valve engines, and locomotive boilers. The reason for this is that the company, when the dredge was ordered, expected at an early date to install a power-plant for generating electricity, and desired to have the then supposed temporary steam-power installed as cheaply as possible. The anticipated change was not made, however, and the fuel-cost is therefore perhaps the highest of any of the coal-burning dredges on the Peninsula, 13 to 14 tons of coal, costing $2 per ton, being used daily. If we take the daily average yardage of the dredge at 2500, and the coal consumption at 13 tons, a fuel-cost of 10·5 cents per cubic yard is indicated.

The Solomon Dredging company, working a 3½ ft. dredge in 7 ft. ground, also uses coal for fuel, and has compound-condensing engines, but it is said that the boiler is too small for the steam requirements. For the last three months, the capacity of the dredge has been about 1800 yd. per day, and the coal consumption 7 tons, costing $22 per ton at the dredge. The fuel-cost indicated is 8·5 cents per yard.

The Wild Goose dredge, with a capacity of 2000 yd. per day burns about 300 gal. of distillate, costing 25 cents per gallon at the property. The fuel-cost indicated on this dredge is 3·75 cents per yard. The Julian dredge, on Osborne creek, is equipped with 2¾ ft. buckets and burns 190 gal. distillate costing

DREDGES OPERATING ON THE SEWARD PENINSULA IN 1911.

| NAME | Bucket Capacity | FUEL | | Horse-Power | Daily capacity | Builders |
|---|---|---|---|---|---|---|
| | | Description | Consumption daily | | | |
| Three Friends | 5† | coal | 12 to 15 tons | 230 | 2350 | Western Engineering. Bucyrus machinery |
| Nome-Montana | 5* | coal | 5 tons | 180 | 1800 | Risdon |
| Kimball | 2½* | distillate | 150 gal. | 90 | 900 | Saupe, Sluice-dredge |
| Sivertson | 2½* | coal | 3 tons | 100 | 1000 | Risdon |
| Flodin | 2½* | coal | 3 tons | 100 | 1000 | Risdon |
| Solomon | 3½† | coal | 7 tons | 160 | 1800 | Bucyrus |
| Wild Goose | 3½† | distillate | 300 gal. | 125 | 1800 | Yuba construction |
| Blue Goose | 5* | wood | 12 cords | 160 | 1100 | I.B. Hammond |
| Alaska Gold Miller | 2½* | distillate | 160 gal. | 90 | 850 | Byron Jackson |
| Alaska Gold, Wellington | 2½* | | 160 ,, | 90 | 850 | Byron Jackson |
| Kimball and Saupe | 2½* | distillate | 150 ,, | 90 | 900 | Empire Iron Works |
| Lubbs | 2½* | ,, | 150 ,, | 85 | 900 | Union Iron Works |
| Beardsley | 2½* | ,, | 160 ,, | 100 | 900 | Union Iron Works |
| Plein | 3½* | crude oil | 13 bbl. at $3·25 | 130 | 1400 | Risdon |
| Saunders. Anderson | 3½† | distillate | 200 gal. | 140 | 1400 | |
| Arctic Middaugh | 2½* | ,, | 160 ,, | 90 | 900 | Union Iron Works |
| Sioux Alaska | 2½* | ,, | 160 ,, | 90 | 900 | Union Iron Works |
| Gold Beach | 5* | crude oil | 18 bbl. | 160 | 1100 | I. B. Hammond |
| Julien | 2¾* | distillate | 190 gal. | 100 | 1100 | Union Construction. Judson |
| Bourbon | 9† | electricity | ... | 325 | 3000 | E. L. Smith Lidgerwood |
| Wonder | 7† | ,, | ... | 275 | 2000 | |
| Tin | 2¾* | distillate | 190 gal. | 100 | 1100 | Union Construction. Judson |
| Cripple River | 11 | ,, | ... | 100 | ... | E. L. Smith Lidgerwood |
| Kelliher | 2⅜ | ,, | ... | 100 | ... | Union Iron Works |

* Open-connected bucket-line. † Close-connected bucket-line.

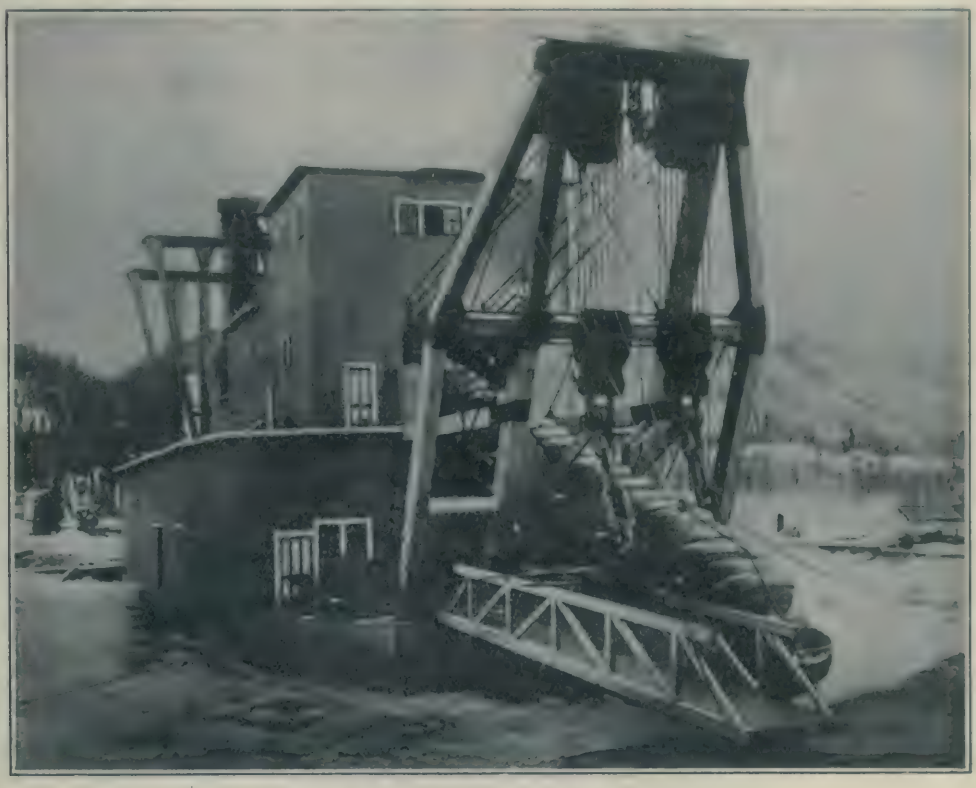
about $42 per day. With a daily capacity of 1100 cu. yd., the fuel-cost would be 3·8 cents per yard.

While other dredges may be quoted, these examples are characteristic and serve to illustrate the advantages of distillate over coal, as fuel. A table by E. S. Rust, in the *Mining and Scientific Press*, of November 4, gives some comparisons of different fuel-costs in Alaska. The 2½ ft. dredges burn about 160 gal. distillate daily at an average cost on the peninsula of 25 c. per gal. and they have an average daily capacity of 900 yds., which would indicate an approximate cost on boats of this size of 44 cents per cu. yd.

Several new plants are proposed for Alaska, among them being an 11-ft. dredge for the Cripple river, and a 2½-ft. machine on the Kougerok, the latter to be sledded over the snow this winter. One of the most interesting of the recent plants is the Wild Goose dredge, which was built by the Yuba Construction company last year, and ran about 3 weeks in 1910. This dredge has had a most successful season, the gross production, it is said, exceeding $225,000. The working cost for the season is reported to be in the neighbourhood of 12 cents per yard, and this the management expects to reduce next year.

While it is not necessary to go into details of operations of all the dredges in Alaska, the accompanying table, which was prepared with the assistance of several operators and dredge-constructing companies, will be of interest. The dredges on the Seward peninsula commence work in the second half of June and the season lasts to the latter part of October, some dredges being able to continue work well into November. At the beginning of operations, on account of frozen gravel, the capacity of the dredge is appreciably less than that obtained later in the season. The Wonder, Plein, and some few other dredges, find it necessary to do considerable thawing; other companies do so occasionally. In the accompanying table the figures must be considered as approximate in several cases.

Most of the dredges started work on or about June 20 and ended their active season on October 24. The Three Friends, Nome-Montana, Blue Goose, and Plein dredges continued operations as late as November. The



*MARION 16 Cu. Ft. DREDGE, NEAR DAWSON.*

Sivertson, Three Friends, Flodin, and Plein plants have a pan-stacker tailing-conveyor; the others are equipped with belt-conveyors. The last two are in course of construction.

The first dredge to be installed on the Yukon was that of the Lewis River Dredging Company, a 3¼ ft. Risdon boat which commenced work on the Lewis river in 1899. This machine worked successfully for a number of years and is still in productive operation, despite having been moved several times to different properties. According to the Auditor-General's office at Ottawa, the following companies are operating dredges in the Yukon: The Yukon Gold, Canadian Klondyke, Yukon Basin, and several smaller companies. The gold production of individual companies is not available, but it is stated that the total output for the district by all operations will exceed $5,000,000 for 1911, the greater portion of which is contributed by the Yukon Gold.

This company has 9 dredges in operation this year, against 7 last year. The dredges put in commission this year were 7-ft. Bucyrus boats equipped with steel hulls built by the Yuba Construction Company, being the first dredges with steel hulls for use in Alaska. With one exception all the dredges of the Yukon companies are of the Bucyrus type. Figures for 1911 are not yet available, but in 1910 six of the dredges averaged 159 working days during the season, and the seven dredges handled a total of 3,249,788 cu. yd. at a cost of 31·09 cents per yard. This includes all thawing charges, gold tax, depreciation, etc. A greatly increased yardage is to be expected for 1911, and probably some reduction in cost. In addition to the dredges, this company operates several hydraulic plants, which, during 1910, handled 1,406,397 cu. yd. at a cost of 25·69 c. per yard. During 1909 the dredges handled 2,381,880 cu. yd. at a cost of 31·94 c. per yard, and recovered 57·24 c. per yard. The dredging recovery for 1910 was 66·18 cents per cubic yard.

The Canadian Klondyke Mining Co., also known as the Boyle concession, is operating two Marion dredges this year. One of these, with 7½ ft. buckets, has been erected this season. As the ground on this property is not frozen, thawing is unnecessary. These boats can operate at a much lower figure than those of the Yukon Gold, the greater portion of that company's ground being permanently frozen. The combined capacity of the two Boyle dredges exceeds at times 14,000 cu. yd. daily. Figures of cost are not available at the present time, but for the 7½ ft. dredge in 1910 the cost reported is 15 c. per yard, a figure which is probably considerably in excess of the present cost, now that the 16 cu. ft. boat is operated. The properties of the Yukon Gold and Boyle companies are on the Klondyke side of the divide, while those of The Granville Mining Co., which has not yet commenced mining operations, are on the Dominion creek watershed. The installation of the power-plant of this company has, according to Fred L. Morris, been most successful and the Granville company now supplies all the electricity for the Yukon territory.

The three companies mentioned control at present practically the whole of the Klondyke mining district, and have spent large amounts in developing and successfully working a territory that for a long time offered apparently unsurmountable difficulties for such operations. In the *Mining and Scientific Press*, during 1909, T. A. Rickard published several interesting articles on this district.

In the Forty-Mile district of the Yukon there were five dredges operating in 1910; an increase of two since 1908. The dredge at Walker's Fork, near Potter Creek, is reported as having had an exceptionally prosperous season. Some trouble was caused during the early part of the season from frozen ground, but, after July, thawing ahead of the dredge was unnecessary. Details of operation for 1911 are not available at the present writing. The gold production from this minor district was given at $150,000 in 1908; and for 1909, at $200,000; all of which did not, however, come from dredging operations.

[An account of dredging operations in Alaska and the Yukon would be incomplete without reference to dredging as applied to tin. On September 10 of last year the first tin dredge to work successfully in the western hemisphere started a successful campaign on shallow placers in Buck creek which is a few miles inland from Cape Prince of Wales on Bering Strait. The owner is the York Dredging Co., of which Mr. W. W. Johnson, of San Francisco, is the moving spirit. The hull of this dredge is of timber and measures 60 by 30 by 6 ft. The buckets are open-connected and of 2½ cu. ft. capacity. During the month ended October 15, when the approach of winter caused operations to be suspended, the daily amount treated averaged 1000 cu. yd., and the recovery was from 2¾ to 3 short tons of cassiterite averaging 68% tin. Details of the working of this dredge were given by H. G. Peake in the *Mining and Scientific Press* for November 18.—EDITOR].

# CONTRACT SYSTEM

By E. A. LORING.

THE contract system employed on the West Australian mines has been so satisfactory to both parties concerned, namely, the contractors and the companies, that a few remarks in this connection may prove of interest.

The work accomplished under this system usually comprises development, stoping, plat and bin cutting, and in some instances, part of the trucking. The price for development work is calculated on the footage advanced, while plat and bin cutting and stoping prices are figured on the fathomage basis. A fortnightly survey is taken of the progress made by each contracting party, and the contractors are paid accordingly, minus the percentage retained against the satisfactory observance of the contract, as mentioned below.

In cases of unforseen difficulties, where the contractors are unable, owing to no fault of their own, to earn as much as the rate of wages ruling in the district, it is customary to make good any loss to the contracting parties. There are several ways of making good this loss, one of which is by simply paying the contracting party the difference between the ruling rate of pay and the amount that they have drawn according to the terms of their contract. Another method is by increasing the contract to a price enabling the party to earn at least the ruling rate of pay, together with sufficient to re-imburse them for their previous loss.

It is sometimes contended that these methods counteract any benefit that the company might derive from the contract system, but it is a well known fact that regular contracting parties have been formed and have been known to constitute practically the same individuals for several years. It must also be conceded that if parties of men bind themselves together, and at the same time, satisfy each other over a considerable length of time, they are most certainly picked men, and it follows that they individually possess much experience, and are capable of carrying out satisfactorily the work entrusted to them.

It is the duty of every mine manager to recognize the ability of parties of men to whom contracts are let, as the responsibility devolves upon him of employing the best men available, in order to accomplish the greatest amount of work for the least expenditure. This result certainly cannot be obtained unless good men are available and efficient supervision prevails. In many cases it has been proved that where underground contractors have made as much as 10s. per shift above the ruling rate of pay, it has been possible for the company to effect a reduction in the total cost per ton of ore handled. It is also an acknowledged fact that good pay will keep the worker content, and naturally a contented man will accomplish more than a discontented one.

If a party of contractors are incapable of carrying out the work they have undertaken, and do not use their best endeavours to surmount ordinary difficulties, the company reserves the right to terminate the contract at any time. The contracts are also invariably drawn so as to allow the company to dismiss any of the contracting persons for unsatisfactory work; and the mining company possess a further safeguard by retaining a fixed percentage of the contract earnings at each pay until the expiration of the agreement.

The trucking is paid for by the contractors, although they do not over-see the truckers, who are under the direct supervision of the shift-bosses. Supplies such as candles, gelignite, fuse and caps, etc., are charged to the contractors, who are also called upon, in some instances, to bear the cost of any machine breakages caused through carelessness.

While the Western Australian system gives satisfaction to the companies, it must also prove equally beneficial to the working man, as I might here mention that an investigation held recently on one of the mines disclosed the fact that over a number of years the contractors made consistently better remuneration than the rate of pay prevailing in the district.

Another point in the favour of workers employed under the contract system is that it allows skilled men to form contracting parties among themselves, and by working in this manner to earn more than would be possible if it were not for contracting, and if they could only accept the ruling rate of pay. The system also proves an incentive for inefficient men to improve their ability, thus enabling them to join contracting parties and reap the reward of proficient workers under the present contract practice.

It will be seen from the foregoing that both the inefficient and proficient workers receive advantages and inducements under the contract system.

# WINTER GOLD-MINING IN SIBERIA

By C. W. PURINGTON.

THE Trans-Baikal region lies between Lake Baikal and the head of the Amur river, and between the fiftieth and fifty-third parallels of latitude. It includes one of the two great divisions of the Imperial Cabinet lands, which are the private property of the Russian Crown. The Cabinet division includes 2,400,000 acres. There is another Cabinet division in the Altai of 112,300,000 acres. The total acreage of Siberia is 3,000,000,000.

The general topographic features are simple. The Trans-Siberian railway traverses a plateau varying from 3000 to 4000 ft. above sea-level. Numerous streams dissect this plateau, maintaining a general depression of from 300 to 500 ft. below the tops of the low hills. In places, ridges rising to 1000 ft. above the plateau traverse the region in a northeast direction. The present topographic sculpture appears to have been determined by a pre-existing rock-structure, as all the rocks are schistose, whether originally of igneous or sedimentary origin, and the direction of cleavage and schistosity is northeast.

Climatically the region is one of the coldest in Siberia. The ten weeks of the year from December 1 to February 15 are the worst. In these months the thermometer falls to −60°F, and it is safe to say the average temperature is −25°. From February 15 to March 30, the average is about −15°, and the early morning temperature from −25° to −30°F. The ice, which forms to depths of from five to seven feet, practically the entire depth of the streams, is not fully liberated until June 1, although previous to this date the climate may even become hot in the middle of the day. There is practically no spring, a climatic leap being taken from winter to summer. In the autumn, a period corresponding to the New England 'Indian Summer,' with most lovely days, lasts from September 15 until October 15, when the heavy frosts begin, and winter grips the country with an iron hand.

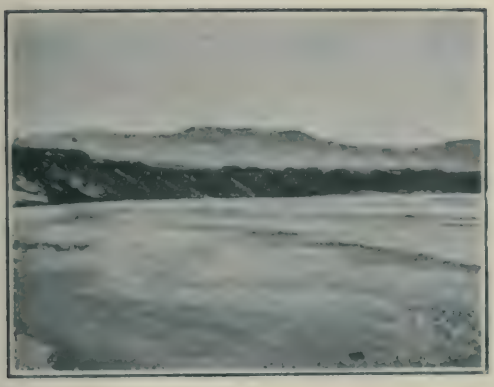
The geology of the region may be briefly discussed. In consists of a complicated series of ancient granite and diorite, with associated slate, schist, and limestone of Carboniferous age. Overlying these there are enormous areas of a loosely consolidated conglomerate, especially in the wide river-valleys. In other places the conglomerate appears to be replaced by nearly horizontal Tertiary clays with heavy lignite beds. These lignites are of good quality, and the fuel is used on the division of the Trans-Siberian railway, known as the Trans-Baikal Stretensk branch.

All evidence shows that the country has been subject to a succession of elevations. The last of these has resulted in terraces or benches bordering the valleys, these terraces frequently being composed of fluviatile gravel. In very few cases, however, has the elevation been sufficient to allow of the subsequent cutting down of the bedrock by present streams. The gravel of the benches usually lies on a bedrock floor on a level with the base of the river deposits. The lowest noted were 30 ft. above the flood-plain, and the highest about 150 feet.

Gold has been produced from this region for a period of 150 years, and almost entirely from the alluvium. The output has been, as nearly as can be estimated, about £17,000,000, the present rate of production in the entire Trans-Baikal territory under Cabinet control being about £200,000 annually.

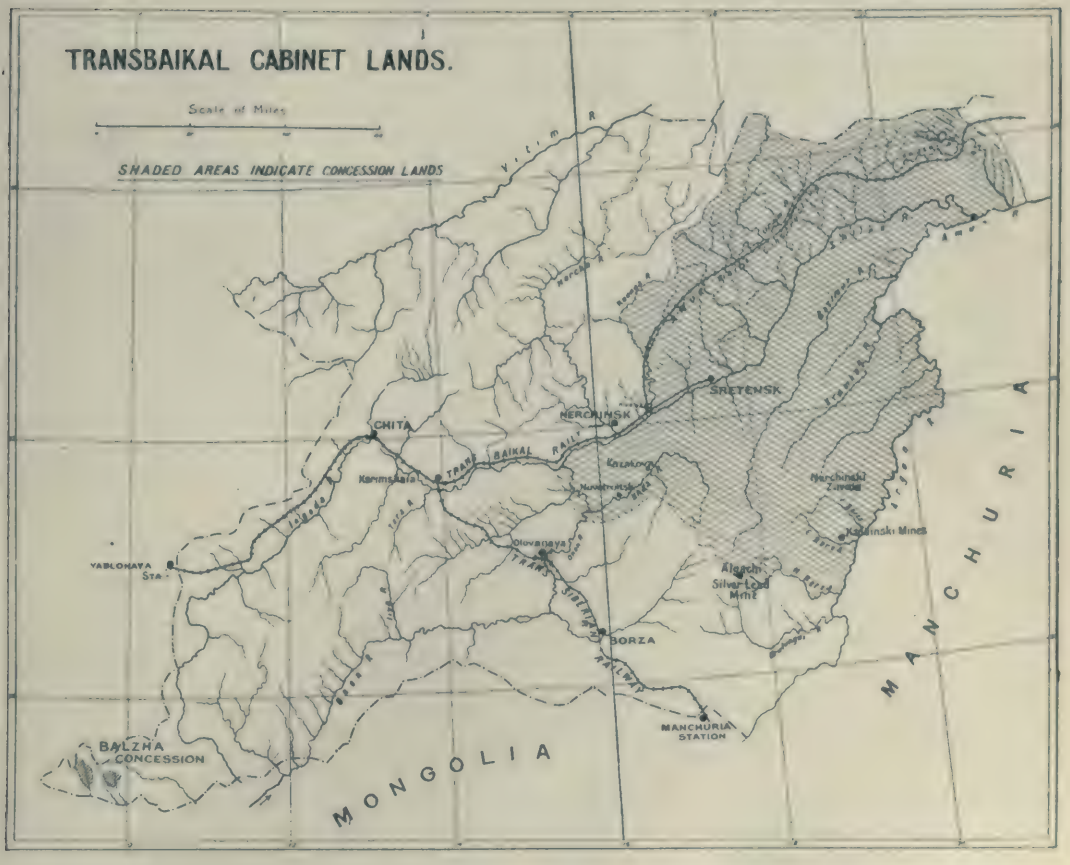
The history of the winning of this gold, mostly by Government, so-called Cabinet work, would be such a record of mingled struggle, privation, cruelty, oppression, inefficiency, freebooting, romance, comedy, and crime as might be expected in a region where a European people has, however crudely, attempted to introduce some modernity into the waste deserts inhabited for centuries only by the wandering Tartar, the lineal descendant of Ghengis Khan. But however fascinating such a history might be, its transcription does not belong here.

The gold-bearing gravel, north of 53° Lat., is permanently frozen. As is well known, permanent frost is different from the annual frost that yields to the summer. The frozen gravel has the consistency of ice, and may be called 'fossil' frost, as its disappearance could only take place by a radical climatic change. It penetrates in the Nerchinsk district through overburden, the gravel, and even in the cracks in solid rock to depths of 100 ft. and more. Such frozen material, which may contain up to 90% ice, can only be satisfactorily thawed for washing by the slow heat from wood fires,



*Novo-Troitsk, on the Unda river.*

*Buriats travelling on the Onon river.*



or by the more modern method of injecting steam through driven pipes. In Alaska special methods of hydraulicking in combination with periodical exposure of a face to the sun's rays are tried, but they are not altogether successful. South of the 53rd parallel, the gravel of the river-beds and adjacent flats or plains is only to a slight extent affected by continual frost, while the gravel of the terraces bordering the river-valleys is, on the other hand, for the most part permanently frozen.

The winter work is done mainly by Chinese tributers. A typical operation may be described. In gangs of five, they start 15 separate pits in a great gravel flat where the depth to bedrock averages 12 ft. The upper five feet is frozen by annual frost, and this must be thawed by wood fires. The thawing process is slow, from one foot in the top gravel to as high as six feet in the unfrozen bottom gravel being accomplished each day. As soon as the fire is drawn in the morning, the gravel is removed, and a new fire started. After the work is done at one pit the whole crew moves to another, and the 15 pits are kept going at the same time. When the frozen zone is penetrated, the trouble with water commences. As much gravel is removed as is safe, then the pit is allowed to stand over-night. The walls and floor freeze. In the morning, a fire must be built and the frozen shell carefully melted, so as to allow of a little excavating. Care must be taken not to allow too much water to enter. It is in the coldest months, December and January, that this work can be done with success. In the beginning of March, when I visited the district, many pits that had been sunk to depths of 15 ft. and over were lost before reaching bedrock. The influx of water was too great to permit of work.

The efficiency of wood in thawing may be reckoned at from one to two feet in vertical or horizontal extension into the bank or about the same thickness as that of the wood piled at the face. The efficiency depends on many constantly varying conditions. The cost of the men's labour being taken at five roubles per day, namely five men at a rouble apiece, and the wood at 50 kopeks, it may be said that the sinking averaged 1·50 roubles per foot.

At the bottom of the pit the pay-gravel, which comprised one yard out of the total four yards in depth, ran 3 R. per cubic yard. It was to get this that the Chinese tributers were making such strenuous efforts and braving the fierce Siberian winter. One quarter of their gross product went to the owner of the mine. It was evident that out of the balance they were paying expenses and making a profit of more than the local wages, namely, one rouble per day. All placers in this district are inclined to be patchy, and undoubtedly the ground ran richer than 3 R. per cubic yard in places.

The gravel was raised either by windlass, or well-sweeps. The well-sweeps under Chinese management are quicker than windlassing. In some cases water had to be baled every alternate bucket. The gravel after being raised to the surface was put in small heaps and subsequently washed in short single sluice-boxes, 6 ft. long by 7 ft. wide, covered and locked. Clean-ups were made only in the presence of the superintendent, who kept the key of the boxes. I watched one gang washing for an hour; less than half a cubic yard was put through in this time, the clean-up amounting to two roubles.

The water for washing was obtained by filling a basin-shaped hole in the frozen surface by use of buckets, the water being heated temporarily by hot stones. Even then in the month of March it was so cold, that I found it impossible to use an iron pan successfully in sampling the ground. The gravel froze to the pan, and unless care was taken the skin was torn from the fingers. The wooden *lotok*, a Chinese form of *batea*, must be used in panning. The Chinese all went to the little office of the mine, and at five o'clock, about dusk, stood in line, while their gold was weighed and recorded, the amount due to the company being deducted. Both night and day shifts were worked, the night-work being principally to feed the fire used in thawing. In the particular instance that came to my knowledge a gross product of about 12,000 R. per month was being taken out, and as the owner employed only one superintendent, and a couple of additional men as helpers, he appeared to have a profitable little business. Working the mine by this system, with an average of 300 Chinese tributers, the property is said to net the owner about 3000 R. per month during the winter season.

This operation is representative of many throughout the Nerchinsk area. The places where gold is coarse, that is, where the 'colours' are larger than the head of a pin, are chosen in preference, as tributers do not like fine gold. Where nuggets occur, stealing inevitably follows, but no particular attempts are made to stop it. Nothing can be claimed on the score of efficiency in working a placer in this way. The numerous shafts, from which insignificant drifts are run in all directions, the

loss of all the ground except the richest spots, the insufficient washing of the gravel in the cold water, and numerous other faults of the system, all result in leaving the ground in the most deplorable shape. Unless the residues prove rich enough to dredge, nothing further can be done with it.

An interesting visit was paid to a camp of the *Zoloto-hishniki* or gold-stealers. These men number many thousands in Siberia, and are the true pioneers of the country. They work where coarse gold only is found, and above the river-bed. The thawing of the gravel was done by means of wood fires, and was very slow work, as the sandy material was solidly frozen. At the bottom of the pit, 15 ft. deep, six inches of pay-gravel carrying at the rate of 20 R. per cu. yd. in coarse gold was encountered. The material above was absolutely barren. The gravel was hoisted in baskets, and washed in warm water. The men seemed to be making good wages, as they were cheerful, and treated us with a considerable display of that bonhomie which is char-

*ZOLOTO-HISHNIKI OR GOLD-STEALERS.*

their reported operations are always followed with interest by the Siberian merchants and others who wish to locate claims. They merely work without the formality of locating claims, as they are generally too poor to stand the expense, and of too roving a disposition to care to stick to one locality; in other words, they have the spirit of the prospector, and as such are worthy of respect. The development of such a class of men in Siberia is a natural result of the ponderous system of mining law which allows only men possessed of capital to mine in a legitimate manner.

In this particular case they were working in frozen gravel, a low bench only about 15 ft.

acteristic of the irresponsible adventurer.

Men of this type appear to be a recognized institution in Siberia. In the Lena district, farther north, there are said to be about 2000 *hishniki*, who work under a certain amount of organization and on a considerable scale, both on claims belonging to the large companies, and on free ground known only to themselves.

The Cabinet manager, Mr. V. U. Kuzuetsof, at Novo-Troitsk on the Unda river, is using a 6-inch Keystone non-traction drill, which was purchased some years ago from a defunct English company. The use of this drill in testing the gravel of the wide flats in winter is interesting; it has been used con-

tinuously throughout the winter of 1910–11, even at a temperature at −60°F. The drill is enclosed within a movable shield of boards. Two shifts are worked, with five men on a shift. The fuel used is wood, and the low price of this, about 1·50 roubles per cord, together with the nominal wages, one rouble per day, makes the cost per foot of Keystone work extremely cheap.

The Unda gravel-flats, at the point where the drill is being used, are about 2000 yards wide. The gravel is fine, with no boulders, no clay, and with a comparatively small amount of sand. It is said not to be permanently frozen, although the intense winter cold causes the frost to penetrate to a depth of seven feet, and it lasts for six months. In many parts of the valley a heavy flow of water near bedrock prevents pit-sinking, in either winter or summer. The drill readily penetrates this frozen ground. The depth of bedrock is 21 ft., the bedrock being a decomposed conglomerate. The drilling averages 21 ft. per day, a move to the next hole being made every 24 hours. The distance between holes is only 35 ft., according to the peculiar Russian method of prospecting. A local concentration of gold has been formed by a sort of eddy on one side of the big flat, where the yield is high enough to warrant work by hand. The drill this winter has proved a block of ground carrying about £15,000 gross, and this will be worked out by hand-labour in the summer. It is reckoned that the profit will be about 10 per cent.

Difficulties are experienced; for example, in the intense cold the transfer of the sand-pump from the hole to the sample-trough cannot be done quickly enough to prevent freezing of the foot-valve. As a result the pump cannot be cleaned thoroughly, and the accuracy of the sample is affected. The cost of the work is nominal. The manager gives it at 75 kopeks per foot, but it is likely that additional items will bring it up to one rouble, or two shillings, per foot drilled.

As to accuracy of results, under such conditions, they leave much to be desired. In the first place, the mechanical part of the work is hampered by the extreme cold. It is tolerably certain that no engineer, however painstaking, especially if he be a foreigner unused to Siberian cold, will devote as careful attention to each sand-pump as it comes up loaded with the test, in the cold winter, as he would in summer. Although both the casing and the sample-trough are supplied with steam-pipes for thawing, it is inevitable that the material will freeze in a few seconds during the coldest weather. The sample-troughs that I saw were full of frozen mud, representing the samples. These must be taken into a warm house, thawed, and washed with clean warm water. The house used for sampling was a low-roofed cabin with small windows, and it was impossible to get much daylight in it. The time for washing cannot exceed six hours in any day. This time does not suffice for thoroughly melting, washing out the box, panning the gravel, and carefully amalgamating the sample from more than one hole in one day. It must necessarily be done by the engineer in charge, or by an expert assistant, and at an entirely different time from the drilling. The tendency to be careless is much greater than would be the case in summer.

Thus while it cannot be said that the winter-drilling on the Nuda does not attain the desired result, according to the Russian system of sampling only the coarse gold of the underlying pay gravel, my impression was that the work entailed great liability to error. Where an accurate knowledge of the entire contents of gold in each drill-hole is desired, as is the case in the sampling of dredging ground, it is doubtful if any modification of the winter-drilling above described would give the desired results during the severe winter of the Trans-Baikal.

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**The Non-ferrous Metals** other than tin do not nowadays play an important part in the mineral industry of the United Kingdom. Copper has greatly shrunk, as compared with 50 to 100 years ago. During 1910, only 3986 tons of ore valued at £14,922 was produced; of this 1300 tons was concentrate averaging 12% coming from the Glasdir mine in Wales, 683 tons averaging 7·3% came from the Levant in Cornwall, and 294 tons averaging 16·6% came from the Talysarn, Carnarvon. The Irish production of 1446 tons averaging 2¼% was classed as cupreous pyrite. The production of lead concentrate was 28,534 tons estimated to yield 21,522 tons of lead, and valued at £232,346. The largest producers were the Mill Close in Derbyshire, Boltsburn in Durham, Bryn-Celyn and Rhosesmor in Flint, Queensberry in Dumfries, and Greenside in Westmorland. The figure for zinc ore and concentrate was 11,238 tons, from which the yield was estimated at 4168 tons, and the value at the mines £53,398. The production of uranium ore was reported at 76 tons, and the only two producers were the Crow Hill and Uranium mines in Cornwall.

# DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

## Origin of Petroleum.

The Editor:

Sir—The article entitled 'Origin of Petroleum' in your November issue seems to me liable to give rise to misconceptions, and as in my own direct personal experience I have found similar misconceptions seriously affecting the progress of at least one important petroleum enterprise, I will with your consent indicate some of the points to which I refer. To start with, the paper which is mentioned as having inspired the article really cannot be taken seriously. Then passing on to the remarks on the theory of the origin of petroleum, it is said: "The upholders of the organic theory insist that as petroleum consists of organic compounds it must have had an organic origin." Anyway, the significance given in the article to the word 'organic' has long ceased to be accepted. However, the position the supporters of the organic origin of petroleum take is that vast accumulations of organic matter capable of yielding petroleum are found buried in the earth, and they regard it as reasonable to suppose that petroleum found ready formed in the earth may have been derived from similar accumulations of organic matter that have come under those influences that are known to make such material yield petroleum. It is very dangerous to suggest that because a deposit of petroleum occurs in a certain horizon, Tertiary or otherwise, therefore it is of a certain origin; inasmuch as petroleum (whatever the origin ascribed to it may be) *given favourable conditions*, may be found, and may and in fact does accumulate, in rocks of any age whether sedimentary or igneous; but where the favourable conditions are known to obtain there it is well to look for it, and as a matter of fact there it is sought and there it is found. Now a little further on in the article is a statement in reference to the inorganic origin which seems to me positively sad. It asserts, "The most important argument, however, is supplied by recent discoveries of the synthesis of organic compounds from the separate elements." Yet this 'recent' discovery had already taken place in 1828; Berthelot too was engaged in the synthesis from inorganic materials of some of the very substances, now under consideration, in 1856; and twenty years later, in 1876, Mendeleeff and also Cloez had prepared naphtha from water and iron carbide, and so added, to those existing, another inorganic explanation for the origin of petroleum. All the inorganic explanations require the assumption that certain special reagents are present in the interior of the earth, and as yet we do not know if these exist or not. Anyhow I venture to suggest that even the most fervid supporter of the organic origin of petroleum would not assert that the carbon which existed before the advent of life on the earth was of organic origin. I have known serious trouble arise from too ardent adherence to a pet theory; better keep an open mind and judge every case on its own special merits.

DAVID A. LOUIS.

London, December 1.

## Single Shift on the Rand.

The Editor:

Sir—The following are a few points for and against the single-shift system, as they have occurred to me, on reading articles on that subject previously published in your magazine. The conditions existing at the moment are:

(1) Shortage of labour.
(2) New mines being developed.
(3) Mines in full going order.
(4) Old mines being worked out.
(5) Introduction of mechanical ventilation.
(6) The adoption of colliery methods, such as mechanical haulage underground.

Let us take the effect of the conditions mentioned under the foregoing headings and see how they affect the single or double-shift system.

(1) *Shortage of Labour.*—The output of the mines must be maintained, in other words, the same profit at least must be made whether labour be deficient or not. This may be taken as an axiom. Let it be taken for granted that with narrow lodes and consequent narrow stoping-widths, hand labour is the cheapest and best method of breaking ground, and let us assume that the average tonnage broken per boy per shift is 1 ton, as a basis on which to compare the various types of machine-drills. The labour force on the mine is continually decreasing, but the tonnage must be maintained and the grade also. The obvious thing is to use more machine-drills, which may be of three types:

(*a*) Large reciprocating machines (about) 3¼ in. diam. cylinder.
(*b*) Small reciprocating machines (about) 2¼ in. diam. cylinder.
(*c*) Hammer-drills.

Machines of the first two types require two

boys each; the hammer-drills require only 1 boy. The average number of tons broken per machine per shift, for the various types of machines are:

(*a*) Large reciprocating machines 11 tons.
(*b*) Small reciprocating machines 5 tons.
(*c*) Hammer-drills 4 tons.

Compared on a tonnage basis, not taking up-keep of machines into account, the relative advantages of the different types of machines, from a labour-saving point of view, over hammer-boys are:

(1) Large reciprocating machines 5½ tons per boy per shift.
(2) Hammer-drills 4·0 tons per boy per shift.
(3) Small reciprocating machines 2½ tons per boy per shift.

To overcome labour shortage the obvious way is to run more machine-drills. A case can thus easily be imagined, by which, in changing from hammer-boys to machines, more ground could be broken on single-shift with machines than could be broken on double-shift with hammer-boys.

(2) *New Mines being developed.*—Again we face an axiom, namely, development must be rushed as fast as possible, at any rate for some time. Under this category shaft-sinking is included. To push development as fast as possible and work on single shift is out of the question; either two or three shifts are worked in 24 hours, the limiting factors being the air-compressor capacity and the difficulty in clearing away broken ore from the development faces.

(3) *Mines in full going order.*—These are at their maximum efficiency. At this stage a mine lends itself best to the adoption of the single-shift system; if the output can be maintained by this system, so much the better, as undoubtedly increased efficiency and safety will result. If the capacity of shaft-bins, sorting-floors and hoisting-plant allow, it may be possible to handle the required tonnage entirely in one shift, otherwise although sufficient ore can be broken in one shift, yet shovelling, tramming, and hoisting will have to be done on double-shift. In addition, development and stope faces must be cleared on night-shift ready for the next day's work. Thus in a mine that has reached a stage when conditions seem most favourable to the adoption of a single-shift system of working, in most cases only the actual breaking of the ground will be done solely on day-shift.

(4) *Old mines becoming worked out.*—As the ground becomes worked out the number of stope-faces is continually decreasing. To maintain the tonnage the stope-faces are changed from single to double-shift, and tramming and shovelling are put on double-shift also.

(5) *The introduction of mechanical ventilation.*—By this means smoke and noxious fumes will be quickly expelled from the mines, which will favourably affect the introduction of double or treble shifts per 24 hours, as the second or third shift will be able to go to the working face almost immediately after blasting has taken place.

(6) *The adoption of colliery methods* underground will effect an economy in labour and with proper organization will facilitate the handling of broken ore, making it possible to do all the necessary tramming and shovelling on the day-shift, while repairs, landing of stores, jumpers, and timber will still be done on the night-shift.

In conclusion, by working a single shift entirely, increased safety and efficiency underground is the result and, in addition, economy and time-saving for repairs, both in respect to the surface plant, such as air-compressors, and also in respect of the underground plant. Generally speaking the single-shift system of working is advantageous, but it is often practically impossible to work a mine entirely on single-shift, by reason of many of the causes mentioned. Mining conditions vary continually and considerably on every mine throughout the life of the mine. Thus although it may be possible to work a mine at one stage of its life to the best advantage on single-shift, yet at a later stage it may be quite impossible to maintain the profits without at least some modification of the single-shift system.

G. HILDICK SMITH.

Johannesburg, November 2.

## Re-precipitation.

The Editor:

Sir—The following notes may be of interest. Some time ago I treated ore from two old dumps in this district. No. 1 dump has small pine-trees growing out of it and is the refuse from the rock mined by the 'ancients' when the method of mining was to light a huge fire against the ore, and when the face was sufficiently hot to apply water. The ore thus produced was broken by hammers, the richest being saved. The residue is the dump, which contains 0·2 oz. gold and 9 oz. silver per ton. There are many roots, small pieces

of decaying wood, and charcoal as well. The ore is a friable iron-stained quartz.

I had many misgivings as to being able to treat it successfully, as I was afraid of re-precipitation, but had ten tons brought to the mill as a test. This was reduced so that 90% would pass 150-mesh, agitated with liquor of strength 0·1% free and 0·25% combined cyanide, and protective alkali 0·06% in terms of NaOH. The proportion of solid to solution was 1 : 3. After 24, 36, and 48 hours air-agitation, samples were taken of the pulp; these were filtered, washed, and assayed for gold and silver, the filtrate being tested for free and total cyanide and protective alkali. The following was the result:

| Time of agitation in hours | Free KCN. | Total Cyanide | Protective Alkali NaOH | Gold Oz. | Silver Oz. |
|---|---|---|---|---|---|
| 24 | 0·07 | 0·12 | 0·06 | 0·05 | 4·50 |
| 36 | 0·05 | 0·10 | 0·03 | 0·01 | 2·35 |
| 48 | 0·03 | 0·08 | 0·02 | 0·01 | 2·00 |

The total time of agitation was 52 hours. The residues contained 0·01 oz. gold and 2·15 oz. silver. The pulp was filter-pressed and water-washed.

No. 2 dump is also an old one, produced similarly to the former, but consists of a different class of ore, being a pyritic quartzite oxidized by the weather and also containing vegetable matter and charcoal. 17 tons containing 0·35 oz. gold and 12·77 oz. silver per ton were brought to the mill and given a treatment similar to the former. The only difference was that one pound of lead acetate was added at the time of crushing and lime equal to 4 lb. per ton was added, after 24 hours' agitation (this in addition to lime added at time of crushing) to the latter.

| Time of agitation in hours | Free KCN. | Total Cyanide | Protective Alkali NaOH | Gold Oz. | Silver Oz. |
|---|---|---|---|---|---|
| 24 | 0·05 | 0·13 | 0·005 | 0·25 | 5·21 |
| 36 | 0·03 | 0·10 | 0·02 | 0·10 | 3·50 |
| 48 | 0·02 | 0·08 | 0·01 | 0·10 | 2·90 |
| 60 | 0·05 | 0·16 | 0·03 | 0·06 | 1·90 |

The strength of the solution was made up to 0·1% free and 0·25% total cyanide after 50 hours agitation, the protective alkali strength being raised at the same time. The agitation was continued for 72 hours, the residue containing 0·025 oz. gold and 1·05 oz. silver.

From 5·2 kilograms of the residue of No. 1 half an assay-ton (14·583 gm.) of fine charcoal and splinters of wood was obtained; this assayed 0·01 oz. gold and 2·50 oz. silver per ton.

The precipitation of the precious metals in the zinc-boxes was 99%.

From these two tests I am led to believe that if free cyanide is present with protective alkali the chances of re-precipitation are small.

A few years ago I was cyanide assistant at the Ashanti Goldfields and in leaching the current tailing, if care was not taken, re-precipitation would take place in the vats. The strange thing about the plant was the action in the zinc-boxes. If these were not cleaned-up once a week the precipitated gold would re-dissolve. The ore was complex and subsequently it was crushed dry, roasted, and cyanided. But the trouble in precipitation continued and was only cured by keeping the solution entering the boxes at a strength of 0·2 to 0·25% KCN.

DONALD F. FOSTER.

Parral, Mexico, November 4.

## The Finance of a Mine.

The Editor:

Sir—The series of articles recently written by Mr. M. H. Burnham in *The Mining Magazine* under the above heading will form most profitable reading for all mining engineers. They are to some extent marred by bitterness, and perhaps by a too obvious reference to a particular case, but apart from that, they express a desire that mining engineers should adopt a high standard of ethics, and should equip themselves at the same time with a proper knowledge of the principles of finance, that they may bring themselves and the industry with which they are connected into the best repute, in which desire Mr. Burnham will have the sympathy of us all.

Mining engineers have now, more than ever, to make valuations; mines change hands more frequently than they used to do, either in their entirety or when shares are bought and sold. By training and experience, mining engineers are usually many-sided, but I agree with Mr. Burnham that in the matter of mine valuation we are as a body behind the present necessities for better principled calculations. Instruction in this subject is generally quite limited at most of the recognized mining schools, and in some it may be said hardly to exist; active engineers have consequently in this matter had to feel their way, receiving in doing so all the knocks that such a method of progress entails. There are even now cases where the past record of a mine is offered as a sufficient index to its future, while present production in this connection is often unduly put forward; generally however it is well realized that the amount of ore developed is of the greatest moment in valuation. This ore

developed is the total tonnage of all the blocks to which a figure for value can reasonably be put from the results of contiguous or adjacent development work. For greater security against the entry of unwarranted figures into this total, it is now the general practice to express in a more detailed statement the different stages in which the various blocks of ore exist relative to the work of development, and for this purpose the ore developed is divided into 'positive,' that which is fully developed, and 'probable,' that which is only partly developed, but which may nevertheless be considered within the limits of the orebody outlined by development.

The amount of positive ore will depend upon the policy under which the exploratory work is proceeding, but it will be easily realized that the amount of probable ore will depend upon all the geological circumstances attending the nature of the ore deposit as well as upon economic conditions generally. Present practice in mine valuation holds that these circumstances and conditions cannot be adequately expressed in any mathematical ratio but that they remain for each case a particular study, resulting in a figurative expression of the engineer's opinion. Concerning the positive ore there can be but little difference in the calculation as to its amount, but as to the amount of probable ore some divergence is reasonable. The division of the developed ore into these two classes is therefore made primarily and almost entirely in order to show in a figure by itself the tonnage about which difference of estimation will certainly occur, the security for each separate estimate being the experience and character of the engineer concerned. Viewed in this light the division into positive and probable ore is not intended as a distinction to be carried any farther; the two figures are put together to form the total of the ore developed, a total which can be rightly used as a basis for valuation. Upon the engineer's responsibility—and he is quite justified in taking it—the present value of the profit in this total amount becomes a figure which common practice would put as a rarely accepted minimum for the capital of any company taking over the property. Mr. Burnham says on page 364, Vol. IV., that "common practice among the more careful engineers often demands that the dividends from the 'positive' or four-sided ore must at least equal the Consol rate ($r' + r''$), leaving the 'probable' to represent $r'''$.." This sentence is not quite clear, because Mr. Burnham does not distinctly say that such demands on the part of these careful engineers were ever actually granted, though the inference is that they were. I have not heard of a case of such terms being the basis of a purchase or sale. I gather rather that in addition to positive ore, probable ore is also paid for, and not only that, but a sum is usually allowed in the capitalization for ore a step farther afield, such ore being known as 'possible.' Mr. Burnham records this general practice in the statement on page 127, Vol. V., where he says, "we pay for probability but hope for possibility, and one measure of financial ability is the price paid for a unit of this comforting sensation." It is in proposing a means of measuring this payment for possibilities that the chief value of Mr. Burnham's work lies, but before proceeding to the examination of his proposals one or two further points regarding present practice in recording the progressive stages of development are worthy of remark. In ordinary working, an orebody is divided into blocks primarily and almost entirely to suit the breaking and removal of the ore. At the same time use is made of the openings thus resulting to obtain an approximate valuation. In every case however the final valuation is not that made in the mine, but that determined from the results obtained in the reduction works. With this final valuation in hand the approximate valuation can be checked, whereby a factor of correction is obtained such as will, when applied, give to the approximate valuation a greater reliability than any other depending upon mine sampling alone. Standard blocks cut and varied according to the patchiness of the ore, as Mr. Burnham would have that they are, to suit the purposes of a more accurate valuation based on mine results alone, do not therefore exist in practice. In ordinary working also the full total of the ore developed is rarely reported, as such a figure does not reflect the activities of the personnel nor the policy of the directorate. These desirable points are however exhibited by a statement of the 'ore reserve,' which reserve is generally taken to be the positive ore *plus* that amount of the probable ore which is above the lowest level and is in a position to be mined at any time. In contradistinction to this, present practice in valuation, under the term of ore developed, formerly termed ore 'in sight,' allows the inclusion of ore below the lowest level, the amount resting with the engineer concerned after a full consideration of all the factors, geological and economic.

In the place of present practice Mr. Burnham proposes that valuation should be more closely connected with mathematics, seeking

thereby "an approximation of the odds for and against" such as "may be attained only by study and an intelligent use of such mathematical machinery as is applicable," and for this purpose he advocates the logical differentiation of risks as between positive and probable ore, and as between one block and another. He further advocates that the date at which each block will go to the reduction works should be assumed, obtaining from this factor, and from the rate at which the risk has been put, the actual present value of each particular block, and eventually thereby the total present value of the ore developed.

Though it is easy to admit the logic of Mr. Burnham's arguments that there should be a larger rate of interest demanded where the risk, consequent upon a less complete development, is greater; and to admit also that the profit in the probable ore will in all probability have to bear a further cut in present value due to the place the probable ore occupies in the sequence of blocks sent to the reduction works, yet it is not so easy to admit that the total present value of the developed ore which he in the end thus laboriously obtains, is more worthy of reliance than that obtainable by present practice, which consists in determining the present value of the series of yearly dividends yielded by the ore developed before it is exhausted. In the present procedure, the blocks of ore are not considered as separate units; the value of an individual block is obtained from its own figures, and so is the tonnage, but these units afterward disappear into the total value and tonnage of the ore developed. Present procedure has not therefore to assume for each block the future date at which it will be milled, but leaves such considerations to the general convenience of operations, demanding only that a regular quantity of ore shall go to the reduction works each year until all is exhausted. At the end of each year the position can be reviewed and the present value amended to suit any possible alterations in the situation, due to exhaustion of the reserve or to addition. The system proposed by Mr. Burnham to my mind offers nothing better than this, as regards the determination of the present value of the ore developed, and his system could only claim more refinement were it the case that each block represented a unit as separate and as handy as a sack of ore. I have mentioned before that in my opinion his standard block does not exist in actual development; it is equally the fact that it does not exist in actual mining. Although in general the positive precedes the probable ore to the reduction works, yet in detail ore is mined in many places and on different levels conforming to the convenience of the moment rather than to any pre-arranged progression.

I am, of course, only stating my own opinion, since this matter has been little ventilated by engineers. It is to be hoped that on Mr. Burnham's initiative many expressions of opinion may follow, this series of articles affording many openings for such expressions.

It now remains to consider the suggestions by Mr. Burnham for the measurement and comparison of the allowances, consciously or unconsciously made, in the capitalization of a mine for the possibilities of the future. This allowance is in each case measured by the difference between the present value of the ore developed and the capital of the company; and this difference, when compared with the profit to be obtained from a unit extension of the orebody, is, as Mr. Burnham points out, some measure of the financial ability of those responsible for the promotion. For instituting comparison between different cases Mr. Burnham takes a horizontal slice, one foot thick, as the unit extension for the orebody, and by dividing the profit expected to be obtained from such a slice, into the allowance for the possibilities, he obtains a figure representing the number of feet over which the orebody will have to maintain its value in greater depth before the capitalization of the possibilities will have been justified.

This method, however, would appear only to form a satisfactory basis of comparison when orebodies of similar nature are being compared. The money value set upon the possibilities of a banket mine in South Africa could not, on such a basis, be equably compared with cases of fissure veins. Within this limitation however it should offer most instructive enlightenment and members of the profession are indebted to Mr. Burnham for bringing it forward.

S. J. TRUSCOTT.

London, December 21, 1911.

## Ball-Mill Practice.

The Editor:

Sir—As Mr. D. F. Foster remarks, in your issue of October, that "we have not yet had sufficient proof that wet-crushing ball-mills are as efficient as heavy gravity-stamps on hard dense ores," I am with him so far; but complete trials have never been made, as far as I know. If the Krupp firm is alive to this

question, let them erect a No. 8 or 11 size mill on the Rand or elsewhere, and prove the wet mill's running cost against a heavy stamp-mill. I feel certain that if a coarse screen is used and the feeding carefully regulated, the result will surprise mill-men. A rotary motion, in my opinion, is more conducive to a quick discharge than that of the stamp. The Giesecke mill was bad in design, the speed for a ball-mill and tube is quite different, and the action of the balls in the former is one of rolling and grinding, and in the latter of impact almost wholly.

Mr. Foster thinks that the building of a ball-mill is not so easy as I make out. Well, let him come here and see how it is done. Such a mill is simplicity in itself; no nice adjustments as in a Griffin or other type. He waxes somewhat sarcastic about building a mill in 24 hours with 28 men. In my paper, I said 8 men. Twenty-eight men could eat it, so to speak. Of course, with low-grade Mexican labour one would require 28, and probably 38, men to do the work. I again repeat that with 8 Kalgoorlie ball-mill men, a mill can be built in 24 hours. Two men can put on all the side plates in four hours. A worn-out mill can be stripped of casing, screens, mantles, and side-plates, and new ones fitted, in 10 to 15 hours by 4 to 6 men. Of course, such work must be well organized, and there should be plenty of room to move about. In my original notes I worked out 1 amp. × 550 volts = 1 hp. for motors driving ball-mills; but I find that 0·8 is nearer the mark for motor efficiency, so we get 52 hp. for the No. 8 Krupp mill, divided into 100 tons crushed daily, or just under 2 tons per horse-power.

With regard to the perforated grinding-plates, these are apt to become burred after three months' work, and should be punched

*THE EL ORO MINE, MEXICO, to which reference is made in the Editorial columns.*

out, or else the capacity of the mill dwindles considerably. It is well to counter-sink the holes before fitting on the mantle plates.

The tonnage ball-milled should be 73,000 instead of 63,000. The cost at the Associated is now 2s. per ton, against 2s. 6½d. The general running of the No. 8 size has brought about this result.

M. W. VON BERNEWITZ.

Kalgoorlie, December 25, 1911.

[Mr. Foster corrected the figure of 28 to 8 men, in a note published in our last issue.—EDITOR.]

### Slime Settlement.

The Editor:

Sir—In the October issue of your Magazine a letter appears from Mr. Courtenay De Kalb asserting that I claimed originality for a device for accelerating the settlement of slime. I wish to point out that no claim for novelty was advanced, and this I think could only have been inferred by the absence of references.

At the time of writing I had no previous knowledge of a practical application of the principle, and it was not until after publication that my attention was drawn to the paragraph in Richards' 'Ore Dressing'; otherwise acknowledgment would have been made.

At the same time it must be admitted that the arrangement as published in the *Journal* of the Chamber of Mines of Western Australia, although embodying the same principle, is a much simpler and more effective application. The use of corrugated sheets increases the efficiency, and the hanging of the sheets freely in the pulp instead of joining them to the sides (which is quite unnecessary) permits the device being fixed to any existing spitzkasten at a lower cost, thereby avoiding the necessity of a specially constructed settler.

B. L. GARDINER.

Salisbury, Rhodesia,
November 25, 1911.

### Stope-Filling.

The Editor:

Sir—I read with interest the able article on 'Water-Borne Packing for Stope-Filling' by Mr. Edgar Pam in your October issue, but I noticed that the author stated in the first paragraph of his article that the process was started in Silesia in 1901, and also made further reference to its adoption in other mining countries. This would give the impression that the system originated in Silesia. That is not so. The idea is of American origin and was first introduced on the property of the Dodson company at Plymouth, Pennsylvania, in 1891.

L. W. Mayer, in his book 'Mining Methods in Europe,' in the chapter on the flushing system, states: "Not many years after the announcement of results at the Dodson colliery, German engineers investigated the field where the process was in successful operation and have since illustrated their approval of the practice by its universal introduction along most elaborate lines in Germany, where it continues to gain favour constantly."

L. A. WOMBLE.

Johannesburg, November 21, 1911.

### East Rand Proprietary.

The Editor:

Sir—The publication of the findings of the commission appointed to inquire into the East Rand affair has finally set at rest the various theories advanced to explain the original cause of the trouble, and it is now seen that the deplorable happenings were not the result of any shortcomings in the intelligence of the cyanide department, as might have been supposed from the tone of the critics. The necessity for expert opinion after the event proves the need of such help during operations. The procedure at the East Rand reminds one of the proverb of the lost horse and the closed door, besides drawing attention to the obvious fact that the treatment plant, as a whole, was without proper working superintendence. This leads to a point that has been brought to light, but to which no attention has been drawn, namely, the amount of friction that occurs when milling and cyaniding operations are placed under separate control. In the present case we know that the tonnage milled was in dispute.

The cyanide manager has positive methods of ascertaining the tonnage received, and any excess recorded over the actual amount means a discrepancy in realization and a reflection on his ability. On the other hand, the mill manager's main object is to show a maximum stamp-duty; and the question of a discrepancy or excess in the production of amalgam or concentrate, as indicated by the assay differences, is seldom raised. Automatic or other weighing machines are generally conspicuous by their absence, with the result that mill-tonnages are only approximate, and sometimes quite in error, being generally arrived at on the basis of the number of cars trucked and without systematic deductions for moisture. Hence the two tonnage estimations

seldom agree, and friction results between the mill and cyanide departments, involving a loss of *esprit de corps* and a lack of unanimity of purpose among the staff. This is as bad for the manager as it is for the company concerned.

Under the system of dual control it is absurd to expect the introduction of economies and a high level of efficiency. Cyanide costs cannot be separated from milling costs when cyaniding commences in the battery and where lime is added to help amalgamation, assist settlement, and protect cyanide. There is no line of demarcation, and, if any attempt at accuracy be made, the costs of treatment in both departments must be lumped together; the result being a total that is of no significance to either the battery manager or the cyanide manager. The alternative is to withhold all working costs from those who are responsible for the introduction of economies, a proceeding that is often adopted and which naturally results in indifference to outlay.

Cyanide consumption cannot be regulated without control of protective alkalinity; the settlement and proper classification of pulp depends on the maintenance of the correct proportion of water used in milling and concentration. Re-precipitation from cyanide solution and consequent loss of gold and silver is a frequent occurrence where insufficient care is exercised in sorting out wood and other organic matter from the ore going to the mill. Cyanide extraction generally depends on the fineness of the product to be treated, and yet, under the dual control system, screen alterations are often made in batteries and seldom after the question has been investigated as to whether a decreased yield by cyanide will be balanced by an increased tonnage. There is also never-ending friction between the two departments as to the right of priority for the services of engineers and fitters, who naturally dislike being under orders from both the battery manager and the cyanide manager, the result often being neglect of important repair work.

No conscientious operator should be placed in a position where, in order to remedy a state of affairs proving detrimental to the efficiency of operations, he is obliged to adopt tactics with the general manager similar to those that would be discouraged in a preparatory school. His position is further complicated in the case where the general manager is, by experience and training, ill qualified to settle disputes on technical points connected with modern metallurgical methods. In the latter case the decision is liable to be prompted by personal bias or personal favour.

The early West Australian practice of placing the entire superintendence of the plant under the working control of a 'metallurgist' has proved eminently satisfactory. In the United States and also in Mexico the case is met in a similar manner by the appointment of a 'mill and cyanide superintendent' with responsibilities similar to those of the 'metallurgist' in Australia. No further proof of the wisdom of the arrangement is needed than the high level of efficiency attained in the large mills of America and Kalgoorlie, and the absence of any occurrences approaching in seriousness the East Rand fiasco.

AFRIKANDER.

December 28, 1911.

### Standardization in Assays.

The Editor:

Sir—With regard to Mr. H. T. Durant's letter, it is clear that he is one of those engineers or assayers who have not had any experience of sampling consignments of ore at British ports or works, otherwise he would have known that it is almost the universal practice to express the moisture in grains per pound, and not in percentages. The two large works he refers to are only following the customary procedure. I think it would be difficult to find an important smelter receiving thousands of tons of ore yearly where the moisture is expressed in percentages, though in saying this I am quite open to correction. The instance he gives of $\frac{700}{7000}$ is of course exceptional, from $\frac{20}{7000}$ to $\frac{50}{7000}$ being the common limits for our large imports of cupreous pyrite.

I might point out that this moisture determination is carried out by the joint samplers of buyer and seller who may or may not have anything to do with the subsequent assay of the sample. The subject of the determination of moisture in shipments of ore and the survival in England to the present day of the old Cornish method, in face of more modern Continental procedure, would form an important matter for discussion. This, however, could hardly be done in the course of a short letter, nor does it seem to fall naturally under the heading of 'Standardization of Assays.'

H. L. TERRY.

Manchester, December 30, 1911.

# PRÉCIS OF TECHNOLOGY

**Gas from Peat.**—Mining engineers in out-of-the-way places often ask for information about the manufacture of fuel-gas from wood. An excellent example in practice is to be found at Portadown in the north of Ireland not far from Belfast, where peat from the Maghery bog is used for supplying power to a linen factory belonging to Hamilton Robb. The plant has been designed and supplied by Crossleys. We quote the following information from *The Engineer* of December 8. The peat after being cut from the bog is stacked and dried, before transport to the plant. On cutting it contains as much as 85% moisture, and in ordinary seasons this can be reduced to 26%. Last summer, being so dry, gave exceptional results, and the water content was only 19%. It is stated that the plant will work satisfactorily if the content is as high as 45%. The cost of the dried peat delivered is 6s. per ton. The plant consists of two producers, each rated at 200 brake-horse-power, with the usual cooler, scrubbers, and tar extractor. The amount of power required at the factory is 275 hp., and the peat consumed per week is 20 tons. The cost of fuel is therefore £6. About 1 ton of tar is recovered every week, and this sells for 35s., so that the cost is reduced to £4. 5s. per ton. Previously to the erection of this plant an anthracite suction-gas producer was used, and the consumption was 8½ tons per week, costing £13. 16s. 3d. The peat plant requires an additional attendant, as the feeding has to be done by hand, and some experience is required to keep the gas production regular. The gas is of excellent quality, being similar to that yielded by anthracite, with rather smaller hydrogen content and slightly higher thermal value.

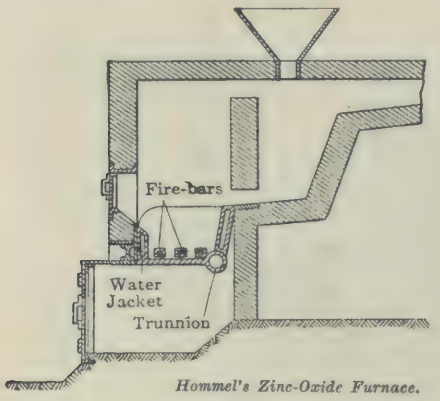
*GAS-PRODUCER USING PEAT.*

**Artificial Diamonds.**—Two months ago paragraphs were published in the daily Press announcing an alleged discovery for the manufacture of diamonds made by Wernher von Bolton, one of the chemists on the staff of Siemens & Halske, Berlin. The actual facts are given in *Zeitschrift fur Elektrochemie* for November 15. He was conducting experiments in connection with electric discharges, when he found that some of the carbon deposit formed in the presence of mercury vapour and coal-gas had a crystalline structure. Acting on this knowledge, he tried to make natural diamond dust grow. He placed sodium amalgam in a test-tube, and covered the remaining free interior surface with sodium silicate; upon this silicate he strewed diamond dust. The tube was kept in boiling water for four weeks, during which time coal-gas containing water vapour was passed over the amalgam. Subsequent examination indicated that some of the carbon deposited on the inside of the test-tube partook of the nature of an addition to the particles of diamond-dust, so that it might be claimed that the particles of diamond had been caused to grow. The individual particles were, however, so small that effective analysis was impossible.

**Emerald Mining in Colombia.**—At the December meeting of the Institution of Mining and Metallurgy, a paper was presented by Charles Olden describing the emerald mines of Colombia. These deposits were known to the aboriginal tribes, and were acquired by the Spaniards by conquest during the middle of the 16th century. The chief mines are at Muzo and Cosquez, 90 miles N.N.W. of Bogota, and the Somondoco, 30 miles east of Bogota. It is believed that all the emeralds wrested from private owners in Peru, Bolivia, Ecuador, and Mexico by the Spaniards came from these mines. On the establishment of a republic, the mines became the property of the state, and have been worked by lessees since. Two years ago a 20 years lease was granted to an English company. The Muzo mine is situated on the steep sides of a basin in the eastern Cordillera. The emeralds are found in calcite veins running in all directions through black limestone of the Lower Cretaceous age. These veins vary greatly in thickness, and the best stones are found in the narrower ones, less than 6 in. thick. Associated with the emeralds are quartz crystals, iron pyrite, green gypsum, and parisite or fluocarbonate of cerium. The size of the emeralds are sometimes considerable; the author saw two taken out weighing 500 and 700 carats. As a rule the crystals are found broken, and are removed in fragments. The emerald is not a tough stone, and does not easily withstand the internal strains of formation or the forces due to contortion and disturbance of the matrix; this also probably explains why emeralds are not found in alluvium.

The limestone varies in thickness from a few feet to 300 ft., and it is covered with from 6 to 30 ft. of earth overgrown with jungle. As a rule the stones are not found below the water level. The author gives an account of the method of exploiting the deposits by means of a succession of benches up the side of the hill, and describes the careful way of breaking and loosening the ground and the method of picking and sorting.

**Zinc Oxide.**—In the *Engineering and Mining Journal* for December 16, W. Hommel describes his furnace for producing zinc oxide by volatilization from low grade ores, residues, etc. He compares his results with those obtained by A. Blum, described in an article in the September 23 issue of the same journal. We gave an abstract of that article in our October number. Mr. Blum's process consists of the application of the Huntington-Heberlein pot, in which layers of zinc material and fuel are placed alternately. Mr. Hommel points out that this application of the pot is not by any means new, and that he himself tried it, but found many disadvantages, which he



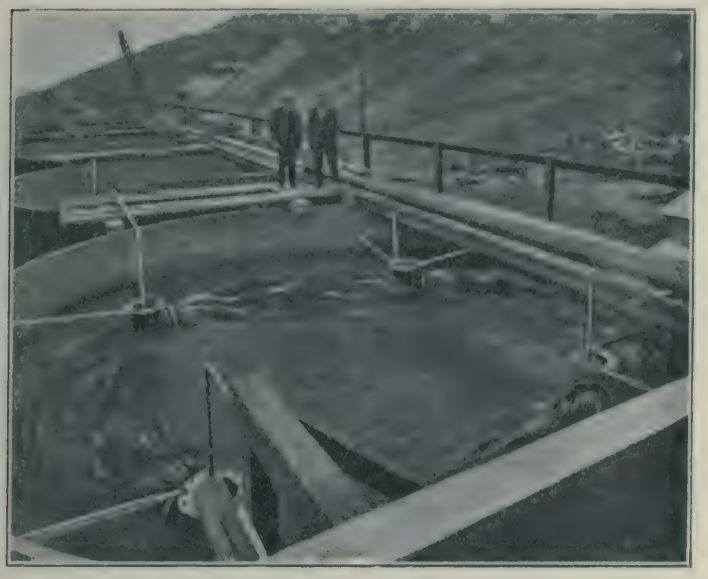

*Hommel's Zinc-Oxide Furnace.*

enumerates. For one thing, the sintering action depends so much on the nature of the ore and material, and seeing that the temperature required for the volatilization of the zinc is 1000°C, in many cases a liquid slag will be obtained instead of a sinter. Then again, the depth of charge is limited to 12 to 15 inches, so that unless the pot is wide the amount of each charge is small. Hommel's furnace is shown in the accompanying illustration. It may be described as a combination of rectangular pot and a furnace chamber. The rectangular shape has the advantage that its sides may be easily water-jacketed, and that instead of a perforated bottom which soon buckles and burns out, a grate of hollow fire-bars may be used. The air is introduced through the hollow fire-bars and trunnions which are thereby kept cool. Behind the converter is a vertical wall or partition of refractory brick, extending across the furnace chamber but leaving free passages both at the top and bottom. Behind the partition is a hopper which feeds the mixture of coal and zinc material into the rear chamber. The floor of this chamber slopes toward the blowing-hearth. While the blowing operation is progressing, the greater part of the escaping gases pass through the upper passage, though some pass below through the mass of material that is being fed in, and gives it a preliminary heating. Thus as each charge is removed another charge is ready for immediate transfer to the converter, already ignited and red hot. No fuel is therefore required for preliminary heating and the time of operation, including charging and emptying, is reduced to less than two hours. The capacity of the furnace is about three times that of a pot of the same size. In his article, Mr. Hommel mentions that the yellow colour of poor quality zinc oxide, obtained direct from the ore or by any other way except by burning spelter, is not always due to iron, but sometimes to small quantities of lead.

**Coating Articles with Metal.**—*Engineering* for December 13 describes a group of processes invented by Q. Marino, for the purpose of depositing one metal upon another or metal upon wood, stone, earthenware, etc. The exact nature of the various baths is kept secret, except in the case of depositing metal on earthenware. The method appears to be somewhat analagous to that of 'Galvanit,' which we described in our issue of March 1910. The rough or roughened surface of the earthenware or glass is coated with a solution of metallic salts, say, silver or copper in hydrofluoric acid, and then a powdered metal such as zinc is rubbed in, the latter causing the precipitation of the copper or silver. Instead of powdered metal, a brush made of fine wires of zinc, copper, or brass may be used.

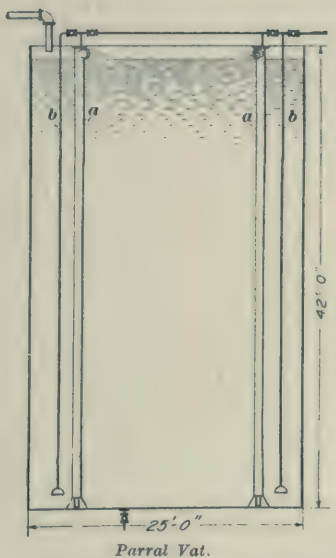
**The Parral Vat.**—In our issue of July 1910 we made reference to an article by Bernard Macdonald in the *Mining and Scientific Press* describing his 'Parral' vat intended to supersede the Brown agitator or Pachuca vat. The principle of the new invention is that the central air-lift pipe is abolished, and in its stead, four pipes are placed nearer the side of the vat and their discharge arranged tangentially so as to give a whirling motion to the pulp. Mr. Macdonald presented a paper, describing the most recent form of his vat, at the meeting of the American Institute of Mining Engineers held in San Francisco in October. Since the publication of the article in the *Mining and Scientific Press*, further experience has been gained, and modifications have been made, especially in the construction of the base of the vat. In the paper now reviewed, Mr. Macdonald points out the disadvantages connected with the Pachuca vat, that his invention is designed to obviate. One is the tendency of the solids to pack in the conical bottom. Another is that the height of the Pachuca as compared with its width necessitates the use of a large amount of air at high pressure in order to effect the circulation, and that the operation of transfer is unnecessarily irregular and violent. With one central lift, the maximum diameter of the vat is limited, because the maximum diameter of an efficient air-lift tube is comparatively small. This consideration affords the reason why a Pachuca is tall and narrow. In some cases, where ground space is limited, this feature has been of direct value. But otherwise, as Mr. Macdonald points out, the shape is a disadvantage, in that it involves the larger amount of steel in its construction than a vat approximating more nearly to equal dimensions in all directions. Five of Mr. Macdonald's vats have been in use at the Veta Colorado mine at Parral for over a year. They may be worked either as separate units or in series. Both systems have been tried, and the difference in efficiency of extraction is not appreciable, but the continuous system has been finally adopted owing to its greater simplicity and less necessity for skilled attention. The vat is flat-bottomed, 25 ft. diameter, and 42 ft. high. It has a capacity 2½ times as great as the standard Pachuca, which is 15 ft. diameter and 45 ft. high. There are four vertical circulation or 'transfer' pipes (*a*), 12 in. diameter, set 12 in. from the bottom of the vat, and 4 ft. from the side. The top ends are fitted with side discharge pipes set in such a way as to cause

a tangential whirl. These pipes and the whirl are shown in the accompanying photograph. The compressed air is admitted at the bottom of each vertical pipe, through a ball valve of special construction. When a vat is being charged, compressed air is admitted through an auxiliary pipe (*b*) so as to prevent settlement during filling. When the charge is within 10 ft. of the top these auxiliary pipes are closed and the air-lifts started. Owing to the whirling motion, the distance travelled by the pulp, and the time occupied, from top to bottom are much greater than in the Pachuca vat,



*The Parral Vat.*

*Pachuca Vat.*

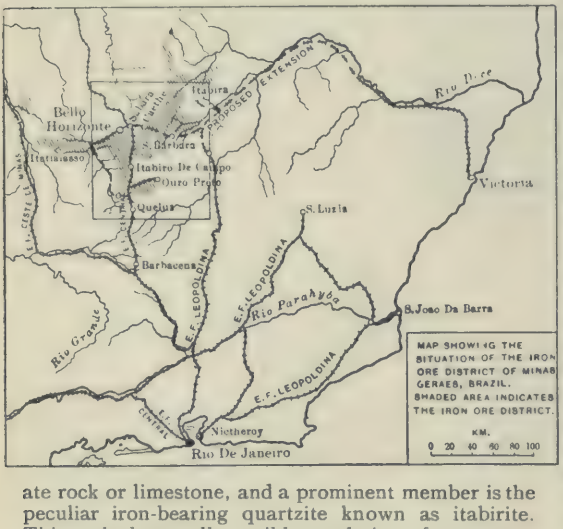



*Parral Vat.*

**Origin and Composition of Coal.**—Vivian B. Lewes delivered a series of Cantor lectures before the Royal Society of Arts during December on the 'Carbonization of Coal.' The study of the effective destructive distillation of coal involves an inquiry into its nature, composition, and origin, and he therefore reviewed this part of the subject at considerable length. The origin of coal is not only of interest to the scientific geologist, but the disquisitions in connection with it are of value as above mentioned to the gas and coke producer and also to the investigators of coal-dust explosions. In view of the recent discussion on the origin of oil, a perusal of Mr. Lewes's paper will prove of interest to many of our readers. Though it is universally held that coal is the remains of plants, it is difficult to determine which particular portion of the vegetable kingdom provided the basis for the deposit, and which part of the individual vegetable growths were preserved; also what were the chemical reactions and physical forces that produced the effect of disintegration and subsequent preservation and carbonization. It is generally held, however, that the chief constituents were: (*1*) the humus derived by the degradation of cellulose and lignite, and (*2*) the resinous and gummy substances produced by plant life. It is conceded that coal is a variable product and that therefore the original constitution of the matters forming it varied within wide limits. Until recently its analysis in the true sense of the word has been impossible, and has been confined to the determination of fixed carbon, volatile matter, and ash, or to the ultimate analysis of the elemental constituents. During the last few years, two new methods of examination have been indicated, one being the discovery by Bedson that pyridine will dissolve part of the coal, and the other the system introduced by Burgess and Wheeler who have closely studied the principles of fractional distillation. The two latter investigators have found that at temperatures below 450°C the gases evolved consist largely of the paraffin series, and that when the temperature of distillation is about 700°C the gases contain a large preponderance of hydrogen. The paraffin gases are considered as being derived from that part of the coal formed from resinous substances, and the hydrogen from the cellulose degradation derivatives. The behaviour of various coals under carbonization action is irregular and has been much of a mystery, but these new ideas go a long way to explain some of the phenomena. It is believed that the portions of the coal soluble in pyridine are those that yield the paraffins in Burgess and Wheeler's reactions. Mr. Lewes does not agree with all their de-

ductions, so their paper, quoted by him, read recently before the Chemical Society, should also be studied.

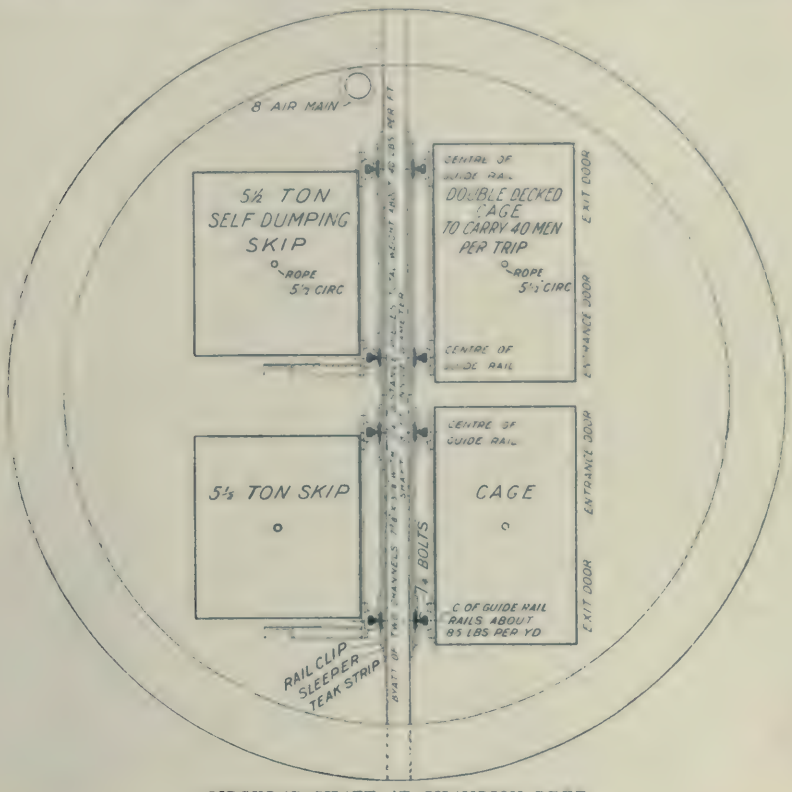
**Hematite Ores of Brazil.**—*Economic Geology* for November contains a paper by C. K. Leith and E. C. Harder on the iron ore deposits of Minas Geraes, Brazil. The authors refer to the standard work on the subject by A. O. Derby, contained in the 'Iron Ore Resources of the World,' published in 1910 by the Stockholm geological congress, and to the publications of the Brazilian Geological Survey under the direction of Gonzaga de Campos. Their own deductions follow closely on those of Mr. Derby, and they give additional information as to the origin of the ores and a comparison between these ores and those found in the Lake Superior district. The Minas Geraes region is constituted geologically by a basement complex of crystalline schists much injected with granite and overlaid by a series of partly metamorphosed sedimentaries which are much folded and faulted. All these rocks are reckoned as pre-Cambrian. The series of sedimentaries consists principally of quartzites and clay slates, with subordinate beds of carbon-




ate rock or limestone, and a prominent member is the peculiar iron-bearing quartzite known as itabirite. This rock shows all possible gradations from a pure quartz with scattered flakes of hematite, to a massive hematite free from quartz, the latter occurring as intercalated layers or lenses. The limestones usually contain flakes of hematite in varying degree, and are frequently associated with commercially valuable ores of iron and manganese. The limestone is a mixture of carbonates of lime, magnesia, manganese, and iron, and it may be regarded as a phase of the iron formation when carbonate deposition predominated over sand and iron oxide deposition. The itabirite becomes friable on exposure to the weather, and as the rainfall is heavy the beds have been greatly denuded. The massive portions therefore stand out boldly, and the lower lands have become filled with iron sand. The authors classify the ores into (1) bedded, (2) fragmental, and (3) secondary. The first class is divided into thick bedded massive hematite and thin bedded laminated hematite or 'jacutinga.' The fragmental ore is differentiated as 'canga,' 'rubble ore,' and 'sand ore;' while the secondary ore consists of both leached carbonate and enriched itabirite. It should be mentioned that the terms itabirite and jacutinga are sometimes used in other senses, the first being made to include the whole of the iron formation and the latter also to soft laminated itabirite; but the authors consider the restricted use of the words more logical. The bedded ores are the most important, and the canga and rubble ore are valuable, but the remainder are of little or no importance. The massive ore beds vary in thickness from less than a foot to over 300 ft., and in length to over a mile. The jacutinga is inclined to be porous, due to the removal of carbonate and silica by leaching. Both ore and itabirite are cut by quartz veins which often carry gold. These veins are probably connected genetically with the granite intrusives. Of the fragmental ore in division (2) the canga is the most important. It consists of fragments of iron ore or itabirite, cemented by hydrated iron oxide, and in places containing much clay and chert. It has been formed entirely from jacutinga or itabirite, and is never found in proximity to the hard massive ores. The authors' belief is that the reserve of high grade ore so far discovered is equal in quantity to that at the Lake Superior region, and that the massive ore is the richest Bessemer hematite in the world. As regards the origin of the ores, the iron oxide may have been deposited originally as ferric hydrate or as carbonate, the first hypothesis being the more probable.

**Braden Copper Mine.**—The *Mining and Scientific Press* for December 16 contains an account, written officially by Pope Yeatman, of the property of the Braden Copper Co. in the Andes, southwest of Valparaiso, Chile, and near the Argentine border. We extract the information given as to the geology of the deposit. The orebodies are found around the periphery of an extinct volcano. The country rock of the district is andesite, and the crater of the volcano is filled with tuff. Geologically the mountain range is young, and was apparently formed in Tertiary times. Though volcanic and solfataric action has long since ceased, movements of the earth's crust are not infrequent. The tuff was the result of a great volcanic outburst that covered the older eruptive rocks with great deposits of volcanic ash, fragments of lava, etc. It is light grey in colour and is cemented into a hard agglomerate. Most of the orebodies are found in the andesite close to the contact with the tuff, though in one case ore is found in a fumarole in the tuff. The crater measures about 4000 ft. across, and is approximately circular, but the periphery is irregular and there are many breaks in the andesite into which the tuff penetrates. The ore is found in cracks and lines of brecciation in the andesite and has been deposited from ascending waters. The deposition is in most cases vein-filling, but in others is a replacement of a constituent mineral of the andesite. The richest portions are usually where there has been the greatest amount of brecciation. In places the brecciated parts were previously filled with rushes of tuff in the form of mud. The ore is not confined to these lines of fracture, but extends into the andesite, and gradually fades away; the boundary of the footwall is determined by commercial reasons alone. The orebodies dip at about 70° toward the centre of the crater. Three have so far been worked, namely, the two Fortunas and the Teniente. The amount of denudation and weathering varies greatly. In some places the former has been more rapid than the latter, so that the sulphide zone extends to the surface; but at the Teniente oxidation has been carried to a considerable depth, and large amounts of secondary minerals are found, such as chalcocite, cuprite, and metallic copper. The old workers used to follow the stringers and ship the rich ore to smelters. The present owners, an American company, have done a great deal of de-

velopment work, and the reserve is estimated at over ten million tons averaging 2·85% copper. There are good reasons for expecting the orebodies to persist in depth : namely, the formation of the ores from ascending solutions from great depths just after violent volcanic disturbance, and the fact that most of the copper minerals from which the veins obtain their value are distinctly primary. A concentrating plant is now being erected, and it follows the main lines of that adopted at the Utah and Nevada mines, but with coarser preliminary crushing and the introduction of jigs. It is expected that the ratio of concentration will be about 9 : 1, and that the concentrate will contain 16% copper, 19% iron, 22% S, with 24% silica, 12% alumina, and 2 lime. The alumina, being contained in felspar in combination with silica, will act as a base in smelting. As regards the method of mining, we refer our readers to Frank Langford's article in the November issue of this magazine.




*CIRCULAR SHAFT AT CHAMPION REEF.*

**Hoisting Plant at Champion Reef.**—The report of the Champion Reef company, issued last month, contains a description of the equipment of the new vertical circular shaft now nearly completed. The shaft is circular and brick-lined, and 18 ft. internal diameter. The depth from the collar to the station platform of the cages will be 3700 ft. The shaft is divided into two parts by steel girders which will carry steel-rail guides for the cages and skips. The capacity was calculated for a minimum of 600 long tons (or 672 short tons) of ore per day, and for raising and lowering 4000 men daily, besides accommodation for timber, tools, and other supplies. A maximum rope-speed of 3000 ft. per minute has been adopted. Self-dumping skips holding 5½ short tons are being provided, and the cages are of the double-deck type holding 40 men. These skips will make 12 trips per hour, so that the raising of the ore will be completed in 10 hours. The cages should do 20 trips per hour. The hoisting ropes will be of best plough steel, 5⅛ in. in circumference, and of 135 tons breaking strain. The headgear is of steel, 105 ft. high from the shaft collar to the centre of the pulleys, and the pulleys are 16 ft. diam. The winding engines are of the double-cylinder type, with cylinders 42 in. diam. by 7 ft. stroke. The drums are cylindrical with conical ends, the smaller diameter being 16 ft., rising on a cone to 17 ft. during the acceleration period, and thence by a spiral in three revolutions to the maximum diameter of 20 ft. The drums are of such a width that there will be no overlapping of the rope. The horse-power is 800, and the steam pressure is 120 lb. Investigation was made with a view of trying compound condensing engines, but it was found that the advantages to be gained in the point of economy in the consumption of steam were outweighed by the fact that the size of the cylinders is determined by the power required to start the load before the effect of the condenser comes into action. Later, when additional power is required, it is intended to install a low-pressure turbine to utilize the exhaust steam. It will be seen that there is a large part of the cross-section unoccupied; as has been explained before in our pages, these odd spaces are valuable in ventilating a deep mine, an aspect of metal mining now receiving more attention.

**Surface Combustion.**—The principle of surface combustion, otherwise known as flameless or contact combustion, was first discovered by Sir Humphry Davy nearly a hundred years ago. Within recent years, since gaseous fuel has been so widely adopted, the subject has once more been revived, and a number of investigators have been engaged in devising practical applications of the principle. As the economical use of gaseous fuel is of importance in metallurgy and in steam-raising, we take this opportunity of giving a short abstract of addresses by Professor W. A. Bone, of Leeds University, delivered in London before the Royal Institution of Great Britain, and to a meeting of the American Gas Institute at St. Louis. Professor Bone has devoted special attention to the subject, and has devised several practical applications. By surface combustion is meant the combination of gases that is effected when the hot mixture in theoretical proportion comes in contact with a heating surface. Under such circumstances, the concentration of liberated heat causes an otherwise unobtainable temperature, and the heating efficiency of the reaction is at its maximum. A lecture experiment which proves the value of this contact substance consists of filling two glass vessels with a mixture of oxygen and hydrogen in the right proportions to form water, one of the vessels containing fragments of firebrick and the other not. If these two vessels are exposed to a temperature of 420°C, the gaseous contents of that filled with brick will gradually combine, with the formation of steam, while the contents of the other will be unaffected. Seeing that slow combustion is thus shown to take place at a temperature below that of the actual ignition point, Davy argued conversely that some substances could be kept hot by the slow combustion of gases without actual flame and below the ignition point. The proof of this supposition is provided by the maintenance of incandescence of platinum wire or foil in a current of mixed coal-gas and air. On the other hand, Professor Bone's studies have been centred on the principle that combination of combustible gaseous mixtures by contact with incandescent surfaces can be effected so as to obtain a flameless combustion at temperatures higher than the ignition points, and he has shown that by this process more heat can be utilized than when we depend only on the radiant heat of ordinary high temperature flames. Professor Bone's experiment showed a mixture of coal-gas with six times its volume of air, passing through a diaphragm of porous refractory material, and raising it to a high temperature, especially on the exit side. If a crucible is surrounded with packing of such material and the mixture of gases introduced into the packing, the heat generated at high temperature is practically all available for transmission into the crucible or tube, and a rapid heating effect is obtained with the greatest possible economy of heat. The limit of the application of the principle is the melting point of the refractory material and the rest of the apparatus. Carborundum is easily burned. Naturally the combustion must be regulated in such a way as to produce the greatest heating effect without destroying the apparatus. Professor Bone and Mr. McCourt have applied the principle to the steam boiler, and a practical application has been made at the works of the Skinningrove Iron Company in North Yorkshire. The boiler measures 10 ft. in length and 4 ft. in diameter, and contains 110 tubes, each 3 in. in diameter, packed with fragments of fire-brick. A suitable mixing chamber and exhaust apparatus are provided, and coke-oven gas is used. The mean evaporation exceeds 20 lb. per square foot of heating surface, or about twice that of the ordinary locomotive boiler. Experiments in connection with melting metals have shown that a ton of lead can be melted at a cost of gas of 5d., with gas at 2s. per 1000 ft.; with coke-oven gas at 3d. per 1000, the cost was only two-thirds of a penny.

**Efficiency of Ore-Roasting Processes.**—Arthur S. Dwight contributes to the Columbia *School of Mines Quarterly* for November a study of the relative efficiencies of various desulphurizing processes used in the metallurgy of lead and copper. Mr. Dwight has made a special study of this question, and his name is well known in connection with the Dwight-Lloyd sintering and roasting furnace. The roasting of lead and copper ores involves two different problems. In treating lead ores, the object is to expel as much sulphur as possible and thus to avoid making matte, and it is necessary to regulate the temperature nicely on account of the fusibility of lead ores and the ease with which lead may be volatilized. On the other hand, in copper smelting, the formation of a matte is the desideratum, and the temperature may be and is much higher. The capacity of various types of furnaces depends (1) on the quantity of ore that can be effectively exposed to the oxidizing influence of air within a given time, and (2) the rapidity with which the oxidizing action can be effected. Large area of hearth and frequent stirring are the means generally adopted for obtaining efficient action under heading (1), and careful control of the heat and air-supply, fine crushing, and intelligent regulation of the chemical composition of the ore mixture are the essential factors under (2). In addition to these considerations, it is necessary to take cognizance of other accompanying conditions, such as the nature of the fuel and labour, repairs, cost of plant, amount of metals locked-up in the process, and the character of the product. With so many variables it is difficult to find a formula to include all and to cover all cases, but after much deliberation Mr. Dwight has come to the conclusion that the best factor by which to judge of the relative value of various furnaces is the number of pounds of ore treated per day on a square foot of furnace hearth. This formula involves the time element, the size of the furnace, the nature of the fuel, and the production of coarse product preferably to fine.

Mr. Dwight proceeds to examine the four principal classes of roasting processes, namely, (1) roast heaps and stalls; (2) reverberatory roasters, hand-stirred and mechanically-stirred, and revolving cylinders; (3) blast-roasting in pots; (4) blast-roasting in thin layers with either intermittent or continuous operation. He gives the following table of efficiencies:

| Type of Process. | Efficiency Factor* |
|---|---|
| Roast heaps and stalls | 5 to 20 |
| Reverberatory Roasters: | |
| (1) Hand roaster | 24 to 35 |
| (2) Mechanically stirred: | |
| average conditions | 33 to 75 |
| special conditions | 150 |
| (3) Revolving cylinders | 128 |
| Blast roasting in pots | 500 to 900 |
| average | 600 |
| Blast roasting of thin layers (Dwight-Lloyd system): | |
| (1) Intermittent down-draft pans | 1000 to 2000 |
| (2) Continuous sintering machines | 2200 to 3000 |

* 'Efficiency factor' is the pounds of ore treated per day per sq. ft. of hearth.

# CURRENT LITERATURE.

**Removing Clay from Ore.**—At the December meeting of the Institution of Mining and Metallurgy, F. A. Killik described a device for washing ore free from clay, used at the Totok gold mines, Celebes.

**Concrete in Mining.**—In the *Mining and Scientific Press* for December 2, A. N. Wold describes some applications of concrete in place of timber adopted in Lake Superior copper mines.

**Concentrating Telluride Ores.**—In the *Mining and Scientific Press* for December 9, T. C. Linderfeldt and J. K. Stewart describe the method of concentrating low-grade telluride gold ore at the Golden Cycle Mill, Goldfield, Nevada. The method consists of dry-crushing and screening, the brittle telluride being saved in the fine, and the coarse containing little or no mineral of value being sent to the dump.

**Pulp Estimation.**—At the November meeting of the Chemical, Metallurgical, and Mining Society of South Africa, H. Stadler read a paper entitled 'Practical Applications of the Specific-Gravity or Moisture Flask,' giving his experience of the application of this method of estimating pulp content. He acknowledged the great value of W. J. Sharwood's articles on the subject that appeared in this magazine two years ago, and amplified some of the applications and formulas.

**Mill Records.**—In the *Mining and Scientific Press* for December 2, A. W. Allen describes a method of keeping records in the mill and cyanide plant.

**Gold Dredging.**—In the *Mining and Scientific Press* for December 9, R. E. Cranston describes No. 4 dredge recently built for the Marysville Co. operating in the Sacramento valley, California.

**Gold Dredging.**—In the *Mining and Scientific Press* for November 25, F. Bushnell describes the big dredge working at Ruby, Montana, 80 miles southeast of Butte.

**Bismuth in Queensland.**—At the December meeting of the Institution of Mining and Metallurgy, W. C. Walworth Pearce presented a paper describing the Glen bismuth deposit in the Herberton district of North Queensland. The bismuth occurs as carbonate, and to a small extent in native form, in veins consisting of topaz traversing granite. Some wolfram is associated with it.

**Flow of Heat through Furnace Walls.**—*Metallurgical and Chemical Engineering* for December contains an article by Carl Hering giving a carefully compiled table of thermal resistances of a great variety of substances. The application of this information is the consideration of heat losses through furnace walls, especially in electric furnaces.

**Microscopical Examination of Coal.**—The paper by James Lomax, entitled the 'Microscopical Examination of Coal, and its Use in Determining the Inflammable Constituents present therein,' read at a recent meeting of the Institution of Mining Engineers, has been published separately in full, together with coloured illustrations.

**Geology of Petroleum Deposits.**—In the *Mining and Scientific Press* for December 9, Dorsey Hager discusses the possibilities in the way of ascertaining the geology of a petroleum district by means of the data obtainable in drilling.

*Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be supplied on application to The Mining Magazine.*

# BOOKS REVIEWED

GEOLOGICAL AND TOPOGRAPHICAL MAPS, THEIR INTERPRETATION AND USE. By Arthur R. Dwerryhouse. Cloth octavo, 136 pages, with many illustrations. London: Edward Arnold. Price 4s. 6d. For sale by *The Mining Magazine*.

This book has been written by the author, who is the lecturer on geology in the Queen's University, Belfast, for the purpose of making clear the interpretation of geological and topographical maps. Though he particularly refers to the British official survey, his instructions are equally useful to civil and mining engineers and geologists in other countries. We have always felt that a book of this kind would be useful to the student in the field, for a map containing details of contours, outcrops, and dips can be made the basis of more deductive argument than is usually supposed except by those who have prepared them. The book also discusses the physical phenomena and mathematical problems in connection with dip, strike, faults. The work is a valuable addition to the excellent series of geological books recently issued by Mr. Arnold.

THE METALLURGICAL INDUSTRY OF ITALY. By Umberto Grioni. Cloth, octavo, 430 pages, with many illustrations and maps. Milan: *La Metallurgia Italiana*.

This handsome volume was prepared for the Associazione fra gli Industriali Metallurgici Italiani, and was intended to be distributed as a guide-book to the members of the Iron and Steel Institute on the occasion of their visit to Turin last autumn. This visit, however, was cancelled for various reasons. The book contains a vast mass of useful and interesting information about the Italian engineering and metallurgical industries. Naturally a large part is devoted to iron and steel. One of the most interesting chapters describes the mines at Traversella, where complex ore containing magnetite and cupriferous pyrite is ground wet in ball-mills and tube-mills, passed through Grondal electromagnetic separators for the removal of the magnetite, and the tailing treated on Krupp and Ferraris tables for the recovery of the pyrite. An account is also given of the lead-smelting works of the Societa de Pertusola, an English company that is quite up-to-date in metallurgical practice. The description of the 'F.I.A.T.' motor-car works at Turin is of timely interest.

TREATISE ON CHEMISTRY. VOL. I. NON-METALLIC ELEMENTS. By H. E. Roscoe and C. Schorlemmer. Cloth octavo, 1000 pages, illustrated. London: Macmillan & Co. Price 21s. For sale by *The Mining Magazine*.

'Roscoe and Schorlemmer' is still the standard general textbook of chemistry in the English language. The new edition now issued has been thoroughly revised and brought up-to-date by Sir Henry Roscoe and J. C. Cain.

GUIDE TO SOUTH AND EAST AFRICA. By A. Samler Brown and G. Gordon Brown. Small octavo, cloth, 490 pages, with many maps and plans. London: Sampson Low, Marston & Co. Price 2s. 6d. For sale by *The Mining Magazine*.

This is a year-book published under the auspices of the Union-Castle steamship company, and is intended not only for tourists and sportsmen but for those who contemplate settling in South Africa or visiting it on business. It is also of great value as a

reference book for those who may never have the opportunity or occasion for obtaining a personal knowledge of the country. The maps and plans are excellent. It is quite impossible to give even an outline of the vast mass of information crammed into the 490 closely printed pages.

BUSINESS PROSPECTS YEAR-BOOK. Edited by Joseph Davies and C. P. Hailey. Cloth, octavo, 290 pages. Cardiff: The Business Statistics Co., Ltd.; London: *The Financial Times*. Price 5s.

Anybody can collect and publish statistics after the events have happened, provided he has sufficient diligence, but it takes a brave and well-informed man to prophesy the future course of business, and to make logical estimates of production and prices. The authors of this year-book have shown a considerable amount of perspicacity in the past, so we always turn to the volumes as they are issued to find confirmation or otherwise of our own ideas. The book covers many branches of commerce, from pork, oil, and rubber, to coal, tin, and copper. As regards the last named, the authors say that during 1912 the demand will be in excess of consumption, stocks will decrease, and as the year progresses prices will improve. Of tin it is said that the demand will remain good and exceed the supply, and that the prices will be above the average of the last three years. The prophesies contained in the book are by no means the only items of interest, for the analyses of the situations in the various industries are clear and acute, and the records of past results are presented in a convenient and not too voluminous form.

THE SOUTH WALES COAL ANNUAL FOR 1912. By Joseph Davies and C. P. Hailey. Cloth octavo, 380 pages, illustrated. Cardiff: The Business Statistics Co. Price 7s. 6d. For sale by *The Mining Magazine*.

This year-book is prepared by the same authors as the publication reviewed in the above paragraph. It is a mine of information as to the production of coal in South Wales, and the methods of marketing it at home and abroad. The mine manager in far countries, desirous of obtaining supplies of coal and coke, will find it a useful reference book. Every year, the issue contains a special article describing some characteristic venture in South Wales. This year the subject is the Rhymney Iron Company. The name of this company has for many years been an example of the *lucus a non lucendo* principle, for its sole business nowadays is coal mining and coke manufacture. In all departments its methods and plants are excellent models of modern practice.

METALLURGY. VOL. I. INTRODUCTORY. By Herbert Lang. Cloth, octavo, 270 pages, illustrated. New York: McGraw-Hill Book Co. Price 12s. 6d. For sale by *The Mining Magazine*.

This is the first or introductory part of a new work on general metallurgy written by a well-known American author and practitioner. We must necessarily defer any pronouncement on the merits of his performance until we have all three volumes before us, but we are safe in saying that the scheme is based on broader lines than has yet been attempted in that it traces the progress of the ores through the various processes, taking the nature of the ore as the starting point, and classifying the possible methods of treatment instead of discussing processes under the heading of each individual metal. This method of handling the subject is of great value both to the student and to the older engineer, also to the man of ordinary intelligence who wishes to ascertain the plan of campaign in tackling a particular ore. For instance it explains why a gold ore may be under certain circumstances more profitably treated as a constituent of a copper or lead smelting charge. It stands to reason that even three volumes cannot contain everything to be said on this subject, and Mr. Lang has had perforce to compress his remarks and to omit details. Consequently the book is difficult to read continuously, for the diet is strong and rich and palls on the palate, in the same way that a collection of witty sayings, each of sparkling beauty, may induce a feeling of boredom. However, to give an account of the contents of the first volume. After giving definitions, the author occupies 70 pages with a dissertation on the principles of crushing and 20 pages to sampling and valuing. Then comes the general tabulation of metullurgical processes, and of the metals, their ores, and the metallurgical characteristics of the latter. A hundred pages are devoted to the roasting and calcination of ores, and to this branch of the subject is added a chapter on fume and gases that seems to have been written on a bigger scale than the rest of the book. The author candidly admits that the book is purely American, and in fact he has rather a poor opinion of English, French, and German literature on metallurgy. This is not quite the ideal attitude for the writer of a general as distinct from a special treatise.

METALLURGY. By A. Fenchel, translated by H. J. Morris. Cloth, octavo, 275 pages, with diagrams and illustrations. London: John Bale, Sons & Danielsson. Price 7s. 6d.

The book is intended for manufacturers, foremen, and workers in the metal industries, and is more particularly useful to those connected with dental metallurgy. The first chapters explain the modern theory of alloys, and the remainder of the book describes in great detail the various alloys, their uses and characteristics. A vast mass of out-of-the-way information has been collected together in this book.

MINING WITHOUT TIMBER. By R. B. Brinsmade. Cloth octavo, 320 pages, with many illustrations. New York: McGraw-Hill Book Co. Price 12s. 6d. For sale by *The Mining Magazine*.

As the supply of timber in the United States is rapidly diminishing, the author has taken this opportunity of drawing the attention of American mining engineers to the various ways of winning ore without the use of timber. He starts with a description of surface work, usually called quarrying in this country, but called mining by steam shovel and glory-hole mining in America; then he passes to underground quarrying with underhand stoping as exemplified in the lead mines of Southeast Missouri, and in the Calumet and Arizona mine where the Mitchell modification is employed. He next describes shrinkage stoping, with and without waste filling, and gives particulars of practice at Wolverine, Homestake, Alaska Treadwell, and many other mines; then he quotes cases of overhand stoping on waste in Mexico, West Australia, and Broken Hill. Examples of pillar-caving are next given, the Miami and Boston Consolidated being of special interest. Back-caving, block-caving, and slicing systems are described, and the author then proceeds to deal with the methods adopted in coal mining. Much of the matter contained in the book has already been published by the author in various American periodicals, and the remainder is culled from articles by other writers in the same publications. The book is a useful companion to Storms' Timbering. It omits all reference to substitutes for timber, such as concrete, steel, brickwork, and dry-walling.

A TEXT BOOK OF MINING GEOLOGY. Third Edition. By James Park. Cloth, octavo, 310 pages, illustrated. London: Charles Griffin & Co. Price 6s. For sale by *The Mining Magazine*.

In the preceding paragraph we have referred to Professor James Park's versatility and clearness as a writer on and a teacher of technological subjects. The new edition of his 'Mining Geology' is welcome. It contains many additions in the way of notes on ore-bodies that present interesting features helpful in the study of the genesis of ores, and on placer and drift deposits. The instances given at first hand naturally refer to Australasia, and for this reason the book is of interest to the student; but in addition the clearness and simplicity of his enunciation of the principles underlying the theories of ore deposits make the book suitable for a beginner.

*ABUJA ROCK, A TYPICAL GRANITE MOUNT IN NORTHERN NIGERIA.*

GEOLOGY AND GEOGRAPHY OF NORTHERN NIGERIA. By J. D. Falconer. Cloth, octavo, 300 pages, with many maps and illustrations. London: Macmillan & Co. Price 10s. For sale by *The Mining Magazine*.

At last we have a reliable and unbiased book describing the geology and geography of Northern Nigeria. Such a book is most welcome and we recommend everybody directly or indirectly interested in that country, whether as engineer, financier, or shareholder, to buy it and study it carefully. The author had charge of the survey instituted by the Colonial Office, and spent five seasons there from 1904 to 1909; he was accompanied at different times by Douglas R. Home and the late Arthur Longbottom. The first chapter describes the physical geography of the province and shows how the Bauchi plateau is at the meeting of the watersheds separating the areas drained seaward by the Benue and the tributaries of the Niger, and inland by rivers flowing into Lake Chad. The physical characteristics of the country are well illustrated by means of photographs. A large part of the book is devoted to a discussion of the crystalline rocks, gneisses, schists, and intrusive rocks; and the remainder describes the Cretaceous, Eocene, and Tertiary rocks, Tertiary crustal movements, and Tertiary volcanic action. The Bauchi plateau is not a table land, but is a comparatively flat country, with a greatest elevation above the sea of 4100 at Ngel and Naraguta, and sloping gradually on all sides. Much of the country is swampy grassland, and there are numerous kopjes of granite. The author notes many veins, dikes, and deposits that contain cassiterite, magnetite, and ilmenite, together or separately, and some with copper, lead, and zinc sulphides also. The rivers rising in the plateau are at first slow and sluggish, but lower down they have cut out deep gorges with waterfalls. The alluvial deposits are at the highest parts, and they have evidently been derived from the weathering of rocks farther north, before recent earth movements made alterations in the relative elevations of various parts of the country. One inference from the author's description is that the alluvium is sure to contain other heavy minerals beside cassiterite; this idea is gradually being proved to be true by the deliveries of mixed concentrate by some of the companies. Another inference is that the tracts of country favourable to the discovery of alluvial deposits and tin-bearing lodes are of considerable extent, and that Northern Nigeria is a land of promise to the prospector.

GEOLOGY AND ORE DEPOSITS OF THE BRECKENRIDGE DISTRICT, COLORADO. By F. L. Ransome. Quarto, paper covers, 186 pages, with many maps, drawings, and other illustrations. Washington: The Government Printing Office.

This is 'Professional Paper No. 75' of the United States Geological Survey. The Breckenridge district is in Summit County, Colorado, 60 miles west-southwest of Denver, and on the west side of the great continental divide. During the last few years it has attracted renewed attention on account of dredging operations. The mineral veins contain complex sulphide ores carrying gold and silver, but they have not provided many profitable mines. Mr. Ransome's examination and report should prove of use to scientific prospectors.

# COMPANY REPORTS

**Cordoba Copper.**—This company was formed in August 1908 as a consolidation of the companies operating the Cerro Muriano and North Cerro Muriano copper mines, situated 10 miles northeast of the city of Cordoba, in the south of Spain. John Taylor & Sons are the managers, William Frecheville is chairman, and James Hocking is superintendent. The ore deposit is difficult to follow and work, and the smelting and concentration are not simple problems. It is noteworthy that the Murex wet magnetic concentration process has been adopted successfully. The report now published covers the year ended September 30, but as the directors intend to make the financial year end in future on December 31 another and fuller report will be issued to cover the 15 months in March next. The operations have been substantially extended during the past year. The amount of ore raised was 86,285 tons, as compared with 61,887 tons the year before, and the reserve has been increased by 66,495 tons, standing on September 30 at 199,398 tons containing 3·59% copper, an increase in grade of 0·31%. Additions have been made to the gas-power plant and the dressing works; the erection of converters has been completed, and since September the output has been in the form of copper bars. Of the ore raised and treated at the company's own plant, 6630 tons was hand-picked and sent direct to the smelter, 2240 tons of rich fine was screened and sent to the sintering pots, and 63,609 tons sent to the concentrators. The latter produced 8238 tons of concentrate assaying 11·1% copper, which was sent to the sintering pots and briquetters, and 9455 tons of middling, assaying 1·47%, which was sent to the Murex plant, where 936 tons of concentrate was obtained averaging 12·2% copper. The remaining ore was hand-picked and dressed by contract, and the products sent to the smelter and sintering departments. Owing to the sintering pots being worked to their maximum, other fine had to be treated by briquetting, the binding material being slime. The smelting plant treated 10,122 tons of picked ore, 7886 tons of sintered material, and 2427 tons of briquettes, and yielded 3439 tons of matte averaging 57% copper. By means of the wet concentrators and the Murex plant the percentage of recovery was 75%; the coarse tailing averages 0·65%, the fine tailing 1·17%, and the slime 1·53% copper. Probably the Murex process has the possibility of further application as details are perfected.

**Corocoro Copper.**—This company was formed in England in 1909 for the purpose of consolidating a number of copper properties at Corocoro, south of La Paz, Bolivia. The control is in France, Baron Rene de Batz is chairman, and Isidore Brun is manager. The yearly report now issued covers the year ended June 30. During this time 67,035 tons of ore was raised from the Guallatiri-Grande, Santa Rosa, Vizcachani, and Toledo, practically all of it coming in about equal proportions from the first three. In fact the Toledo has since been closed. After hand-picking, 47,481 tons averaging 3·36% copper was sent to the dressing plants, where 2038 tons of concentrate was produced averaging 77·38% copper. This production is 268 tons higher than during the year before. The trading profit is returned at £13,458, and after administration expenses and taxes were paid, a net profit was made of £9906, which was carried to the balance-sheet, making the total balance £14,382. It is intended to write off £6260 for depreciation and £7000 from preliminary expenses of formation. The cost of producing the copper is given at £47. 12s. 2d. per ton, of which £37. 13s. is the cost at Corocoro, £1. 6s. 9d. export duty, £4. 12s. 5d. transport to the coast, £2. 2s. freight to Europe, and £1. 18s. commission on selling, etc. The railway connecting La Paz with Arica is expected to be ready for traffic in June next, and the policy is to build a short branch line to connect the mines with it. The cost of supplies and transport will then be substantially reduced, and it will be possible to develop the oxide ore. Mr. Brun reports that the reserves of ore at the various properties are "colossal."

**Pahang Consolidated.**—This company was formed in 1906 for the purpose of consolidating the Pahang Corporation with other companies operating adjacent lode and gravel tin properties in the state of Pahang, on the eastern side of the Malay peninsula. The management is in the hands of the Borneo company, and J. T. Marriner is superintendent, having succeeded Reginald Pawle recently. Three years ago it was found that the reserve had been greatly over-estimated and that energetic development was urgently needed. Reginald Pawle and William Frecheville visited the properties and recommended the provision of additional capital in order to place the mines in a better position as producers, and £125,000 new capital was accordingly issued. The report now published covers the year ended July 31, and shows that 78,448 tons of ore was treated in the 50-stamp mill, yielding 973 tons of concentrate; these figures compare with 80,736 tons and 908 tons during the previous year. In addition 54 tons of concentrate was obtained from gravel mines, as compared with 54½ tons, thus bringing the total production to 1027 tons. Ore was extracted from seven lode mines, of which Willink's and Bell's provided most. The income from the sale of concentrate was £115,274, and the profit £21,232, out of which £4390 was paid as interest on debentures, reducing the balance to £16,842. The year commenced with an adverse balance of £19,364, and ends with a similar balance of £2521. Mr. Marriner is not pressing forward the erection of the four Holman air-cushion stamps, as he does not consider that there is sufficient ore to keep any additional plant going, and in the meantime he recommends a number of improvements in the concentration plant that will give a greater extraction and at less cost; for instance the provision of re-grinding machines for the jig and table middling, new slime concentrators, and an improved roasting furnace. The Elmore vacuum plant for removing pyrite has been put out of commission. As regards ore reserves, Mr. Marriner considers that there is an 18-months supply, but as the ore is patchy and the workings scattered, he is averse to giving any estimate of its value, or an opinion as to the results of future developments. At Willink's mine some of the recent prospecting work has given hopeful results.

**St. John Del Rey.**—This company possesses the double distinction of having been in continuous existence for 80 years and of owning the deepest gold mine in the world, the Morro Velho, in the state of Minas Geraes, Brazil. The half-yearly interim report for the period ended August 31 last shows that 99,474 long tons of ore was raised and after the removal of waste, 96,600 tons was sent to the 130 stamps and cyanide plant, where bullion worth £217,397 was recovered. The yield per ton was 30s. 7d. by amalgamation and 14s. 5d. by cyanide, a total of 45s. As compared with the corresponding 6 months of the previous year, the ore treated shows an increase of 4200 tons, the yield an increase of £12,738, and the recovery per ton an increase of 10d. The working cost was

£135,336, local taxes £9392, development £6059, and London expenses £2193, bringing the total cost to £143,586, or 31s. 7½d. per ton milled, a slight decrease. The balance of profit was £64,715, out of which £2375 has been paid as debenture interest, £1625 as income tax, £5292 distributed on the preference shares, and £21,680 on the ordinary shares, being at the rate of 7½% per annum. The remaining £33,740 has been transferred to capital account for new works. The operations have been carried on under more favourable circumstances during the half-year, as additional power is now obtained from the Peixe river hydro-electric station. This plant is being doubled, and when the further supply of power is thus obtained, it will be possible to work the lode to horizon 20, or 900 ft. lower than the present deepest level, horizon 17, which is 4900 ft. vertical. The development on horizon 17 is proceeding satisfactorily and there is every indication of the ore being of equal quality to that which has been found in the levels above. As usual, the report of George Chalmers, the manager, is full of interesting details relating to the progress of the work.

**Champion Reef.**—This mine belongs to John Taylor & Sons' group of gold mines in the Kolar district of India, and is situated immediately to the north of the Mysore. For many years the production and profits were maintained at a high level, and the Champion Reef was one of the great mines of the world. Four years ago the content began to fall and it is now not much more than half what it used to be. The report for the year ended September 30 shows that the mine is producing rather better ore and that, owing to economies effected in connection with the electric power, the profits have increased. During the year 205,169 short tons of ore was raised and the yield was worth £468,290, as compared with 209,081 tons and £441,255 the year before. The working expense was £280,236, a reduction of £13,607. There were other small items of income and expenditure, and the balance of profit was £173,473. Out of this, £30,343 has been spent on shaft-sinking, £2500 deducted for depreciation, £15,000 allocated for the purpose of starting a reserve fund, £6822 paid as income tax, and £112,666 paid as dividend, being at the rate of 1s. 1d. per 2s. 6d. share or 43½%. The dividend last year was 23½%. In addition £48,897 has been spent on capital account, out of funds provided by the issue of new shares two years ago, on shaft-sinking and plant, chiefly for the new circular shaft. The 'working cost' per ton was 27s. 3d., as compared with 31s. 6d. in 1909–10, and 34s. 9d. in 1908–9. The maximum capacity of the Cauvery Falls hydro-electric power plant, belonging to the Indian government, has been reached, and additional reservoirs and generators are now being built. The supply of power for the new shaft and for any other extension will come from the new station. A vacuum filter has been erected for the purpose of treating slime; there are large accumulations of sand and slime awaiting treatment, and of tailing that will pay for re-treatment. Developments in the mine have on the whole been satisfactory during the year and the reserve has been slightly increased, amounting on September 30 to 365,296 tons. The new vertical circular shaft, that is designed to serve the lower workings, was down to 3034 ft. on September 30, and a cross-cut at 3000 ft., 956 ft. long, had made communication with the 33rd level, greatly improving the ventilation of the mine. We give a description of the hoisting plant in our Précis of Technology. Additional land has been purchased on the western boundary, as it is expected that the deep levels will ultimately pass out of the present limits. The seller is one of the holding companies belonging to the same group.

**Ashanti Goldfields.**—The yearly report of the leading gold-producing mine in West Africa covers the period ended June 30. During this time 111,209 long tons of ore was treated, of which 59,046 tons came from the Obuasi group (Ashanti and Ayeimn) yielding 25 dwt. per ton, and 52,163 tons from Justice's yielding 8 dwt. per ton. The total recovery was 96,275 oz or 17·31 dwt. per ton. In addition 3919 oz. gold was recovered from old residues, bringing the value of the yield to £428,129. Expenses in Africa and London, including royalty, were £218,566; in addition £24,808

was written off for depreciation, and £32,493 transferred to reserve for development redemption. Another item of outgoing was £10,345 paid as extra remuneration to directors; as is well-known to the shareholders this charge is of the nature of a founder's share, and is a recompense for the otherwise unrewarded work in the early days, when but for the founder-directors' energies and money the venture would have collapsed. The net profit for the year was £144,565, and £69,068 was brought forward from the previous year; £152,951 was distributed as dividend, being at the rate of 75%. The last unit of the new metallurgical plant was completed early in 1911. During the year abnormal rainfall interfered with work both underground and on the surface and enhanced the cost of operations, but since June 30 the conditions have improved and the cost has once more been reduced. The ore reserves on September 30 were estimated by W. R. Feldtmann, the consulting engineer,

at 93,453 tons averaging 19 dwt. and 81,300 tons averaging 40 dwt. in the Ashanti mine, and 130,000 tons averaging 8 dwt. in the Ayeimn, these two mines forming the Obuasi group; while at Justice's the figures were 68,000 tons of oxidized ore averaging 13 dwt. and 81,000 tons of sulphide ore averaging 11½ dwt. The total was 453,750 tons averaging 17½ dwt. as compared with 485,566 tons averaging 18½ dwt. the year before. Mr. Feldtmann shows that the decrease in quantity and content is due to the smaller amount of ore developed at the Ashanti mine during the year, but he reminds shareholders that the variable occurrence of the high-grade ore is the cause of irregularity in the rate of addition to reserves. Since September 30, the discoveries in the Obuasi shoot at the Ashanti mine have been most promising, and have already been reported in our pages.

**Dunderland Iron Ore.**—This company was formed in 1902 to acquire iron ore deposits at Dunderland, near the port of Mo, on the west coast of Norway. Sir Joseph Lawrence, of linotype fame, was the promoter, and the scheme was actively supported by many iron masters in the north of England and in Wales. The Consolidated Gold Fields of South Africa also took a substantial interest. The ore consists of hematite and magnetite in a silicious gangue that contains much apatite. The plan was to crush and concentrate dry, but all sorts of mechanical difficulties arose and finally the plant had to be closed. More recently the Ullrich wet method of magnetic concentration, governed by Krupps, has been tried on an experimental scale. The report now issued covers the year ended September 30. It shows that the Ullrich plant is considered applicable to the ore by Henry Louis, and that plans have been matured for erecting a plant capable of treating 200,000 tons per annum. The intention is to obtain current and power from waterfalls, and negotiations are in hand with a view to the erection of a hydro-electric station. These arrangements are not yet complete, nor are those for the provision of the new capital. The balance sheet shows £1,000,000 in ordinary shares, a similar amount in cumulative preference shares, £533,100 debentures, £113,482 funded debenture interest certificates, and £200,100 prior lien bonds. It will be seen that the company is almost hopelessly waterlogged in the way of debts and shares, and the financial way-out is not quite evident. The meeting of shareholders held last month was adjourned to a later date, when the new proposals will be expounded.

**Van Ryn.**—This mine is situated in the far east Rand and belongs to the Albu group. Milling started in 1892, and a dividend was paid in 1895, but it was not until 1904 that the company gained a position of settled prosperity. The report now issued covers the year ended June 30 last. It shows that 410,246 tons of ore was mined and raised and 26,110 tons taken from the dumps. After the removal of waste, 396,950 tons was sent to the mill, where 101,869 oz. was recovered by amalgamation and 31,863 oz. by cyanide, a total of 133,732 oz., valued at £566,765, the extraction being 28s. 7d. per ton. The working cost was £304,425 or 15s. 4d. per ton, leaving a working profit of £262,340 or 13s. 2d. per ton. From the profit had to be deducted £16,299 for depreciation and £35,194 for taxes, and £225,000 was distributed as dividend, being at the rate of 45%. The renovation of the batteries has been completed during the year, and while the alteration was being carried on, only 130 stamps were running. The 160 new stamps are of a heavier type than the old 180, and with the 6 tube-mills, will insure a larger output in future. Much money has also been spent during the year on preparations for filling exhausted stopes with sand residue, a policy adopted on account of the collapse that occurred recently. The ore reserve has been increased during the year by 65,199 tons, and on June 30 stood at 1,655,910 tons averaging 6·37 dwt.

**Knights Deep.**—This mine belongs to the Consolidated Gold Fields group and is on the dip of the Glencairn and part of Knights, two Barnato properties. The metallurgical equipment consists of 270 stamps and 6 tube-mills, 70 of the former being leased from the Simmer East, an unsuccessful 'second deep.' The report for the year ended July 31 shows that 737,957 tons of ore was raised and, after sorting, 695,670 tons was sent to the mill; this was an increase of 44,850 tons as compared with the previous twelve months. The total yield by amalgamation and cyanide was 161,369 oz. worth £680,869, being a recovery of 19s. 7d. per ton milled, as compared with 21s. the year before. The working cost was £407,989, or 11s. 8d. per ton. This performance is noteworthy, as it is the first occasion that the working cost on the Rand has been below 12s. per ton. The working profit was £273,735 or 7s. 10d. per ton. This profit is of course not the divisible profit, but the other items of disbursement, taxes, renewals, etc., are not as great as in some cases, being only £20,902. In addition debenture interest absorbed £8570 and £23,900 was appropriated for redemption of debentures. Shareholders received £225,234, being at the rate of 35%. The reserve of ore on July 31 was estimated at 1,650,000 tons averaging 5·2 dwt., as compared with 1,700,000 tons averaging 5·5 dwt. the year before. There are also large amounts of ore partly developed. Owing to shortage of native labour, the use of hammer-drills has been extended. It is also interesting to note that the mine is becoming so dry that it is now necessary to buy some of the water required in the mill and cyanide plant.

**Penhalonga.**—As recorded in our issue of October, this company was drastically reorganized in that month, with regard to both the shares and the debentures, and additional capital raised. The company was originally formed in 1898 to acquire a gold mine in the Umtali district of Rhodesia, and the control has been with the Anglo-French-Farrar combination. C. R. Pinder is the consulting engineer, and S. R. Jameson is manager. The report now issued covers the period from the reorganization to June 30 last. During this time an average of 52 out of the 80 stamps have been running, and they treated 49,900 tons of ore, assaying 4½ dwt. gold, 2½ oz. silver, and 37 lb. lead per ton. By amalgamation and concentration, the production was 9746 oz. gold, 74,525 oz. silver, and 475 tons lead. The yield in the mill was worth £17,161, and the metals in the concentrate, which is shipped to Europe, were returned as worth £37,176, making the total income £54,337, or 21s. 9d. per ton milled. The cost, including development redemption, and charges for realizing the concentrate, was £52,107, so that the working profit was £2230. After London expenses were paid and depreciation allowed, the net balance was £966. During the past year, the main shaft has been sunk, with a view to the exploitation of lower levels, in the hope that more settled country may be found. A proposition has been made to amalgamate with the Rezende, a company owning an adjacent property that has recently come into the control of Anglo-French-Farrar group, and having the same administrative and engineering staff. The Anglo-French representatives are, however, opposed to the step, and at the meeting of shareholders the consideration of the mat-

ter was postponed and an adjourned meeting called for February.

**Tanganyika Concessions.**—The financial year of this company has been altered so as to end on December 31 instead of June 30, and the period covered by the report now due will be from July 1, 1910, to December 31, 1911. This will be issued in the spring. In the meantime a meeting of shareholders was necessary last month in order to comply with company law. No statement of account was then presented, but Robert Williams, the managing director, reviewed the situation at considerable length. By far the most interesting statement made at the meeting was the disclosure of R. J. Frecheville's estimate of 1,800,000 tons of developed ore averaging 12% copper. His report made for the Consolidated Mines Selection company had never been published, and as his clients did not take any financial interest it was supposed that his opinion was unfavourable. All doubt has now been removed by this public statement, and Mr. Frecheville's cautious attitude is proved to be due to

*MAP OF CENTRAL AFRICA, SHOWING PROPERTIES OF TANGANYIKA CONCESSIONS.*

of utilizing the Lufira waterfall for the generation of electricity. The first furnace started on June 30, and experimental runs were made until August 27, when operations were stopped in order to alter the dust chamber and the charging apparatus. Work was resumed on September 16 and the furnace ran for two months, producing 1000 tons of copper. Another stoppage then occurred for the purpose of making further alterations and also to await additional supplies of coke. The recovery was 87% of the content of the ore, 2½% went into the flues, and 10½% was lost in the slag. The results were sufficiently satisfactory to warrant the erection of a second furnace of similar capacity. Mr. Williams also spoke of the nature of the ore deposit and stated that the traces of pyrite found held out hopes of a change to sulphide ore at depth. This, however, is a debatable geological question, for there is a strong probability of the deposit having been formed by descending waters which brought copper in solution from a previous igneous deposit.

the economic problems centreing round the absence of railway communication. A second item of importance related to the cost of coke. The coal resources of Wankie and Luano valley were not utilized, because nobody thought fit to erect washers and coke ovens, and the first smelting campaign was necessarily done with European supplies. This coke costs £12 per ton at the smelter instead of £10 as estimated, and smelting operations have proved that owing to the necessity of adding low-grade silicious ore for fluxing purposes, the consumption of coke per ton of copper produced has also been greater than the estimate. Recently a seam of better quality coal has been found at Wankie and negotiations have been made with the colliery company and the Rhodesian railways to make coke and deliver it to the smelter at a more favourable price, namely £5 per ton. Experiments are also being made with Luano coal, which is controlled by the Tanganyika company. Mention was made by Mr. Williams of the possibility

**Glynn's Lydenburg.**—This company was formed in 1895 to acquire a gold mine on the Sabie river in the Lydenburg district of the Transvaal. Milling commenced in 1897 with ten stamps, and profits have been made continuously. The plant now consists of 20 stamps and a tube-mill. The control is with the Central Mining Co., and G. C. Damant is manager. The report for the year ended July 31 shows that development work has been hampered by shortness of native labour, and that repairs to the stamps reduced the running time by nearly a month. The amount of ore milled was 33,870 tons, yielding 7405 oz. by amalgamation; 22,148 tons of sand yielded 7027 oz., and 11,722 tons of slime 6406 oz., bringing the total production to 20,838 oz., worth £86,739, or 51s. 2d. per ton milled. The working cost was £32,360 or 19s. 1d. per ton, and the profit £54,378, or 32s. 1d. per ton. General administration expenses absorbed a further £5078, and £5278 was paid as taxes, while £42,500 was distributed as dividend, being at the rate

of 25%. As already mentioned, development has been curtailed by want of labour, and the reserve on July 31 was 73,280 tons as compared with 82,870 tons a year ago. Mr. Damant states that during the last three years several other mines have started in the same district, and cause competition in the labour market, but the most serious drain is the Selati railway.

**Gaika.**—This company was formed in 1902 by the Rhodesian Exploration & Development Co. to acquire a gold-mining property near Que Que, and not far from the Globe & Phœnix. Milling commenced in 1902. The report now issued covers the year ended June 30 and shows that 29,550 tons of ore yielded by amalgamation and cyanide gold worth £50,736; of this amount 12,895 tons was drawn from the ore blocked-out and estimated to contain 15½ dwt. per ton, while the remainder was development ore averaging 11 dwt., surface dump ore averaging 4 dwt., and ore from the Robin Hood lease averaging 6 dwt. The recovery was 81½%; about 11½% of the remainder is in the slime which is stored for future treatment, and the estimated loss was 7%. The ore is not easy to treat as it contains antimony. A large amount of development work has been done during the year, especially on the North Reef, the total footage being 4918; the results have been generally satisfactory, and the lower levels, the 6th and 7th, have been shown to contain a lode 4 to 5 ft. thick assaying 12½ to 24 dwt. The ore reserve on June 30 was estimated at 30,000 tons, averaging 15 dwt. The Robin Hood mine, hitherto worked on tribute, has been acquired by the company, and development below water-level is to be actively prosecuted. As regards the financial results of the year's work, the value of the gold won was £50,763, and other items brought the total income to £52,142. The cost at the mine was £27,389; this does not include development. London expenses were £1540, allowance for depreciation £2787, income tax £695, debenture interest £705, leaving £19,024 as profit. From this is deducted £7247 for development redemption, and £13,024 was distributed as dividend, being at the rate of 5%.

**Selukwe Columbia.**—This company was formed in 1900 by the Rhodesian Exploration & Development Co. to acquire a gold mine in the Gwelo district. The first operations were not successful, so the mill was closed. In 1908 the company was reconstructed and additional capital raised, and mining and milling resumed in May 1909. The report now issued covers the year ended June 30, and shows that the position continues to improve steadily. A larger amount of ore is now being treated and it is of better quality. The tonnage milled was 31,535, and the total recovery 15,722 oz. worth £66,490. The plant consists of rolls, a Chilean mill, 3 amalgamating pans, and cyanide plant. The working cost including development was £48,268, London expenses absorbed £1520, allowance for depreciation of plant £3246; there were other small items, and the profit was £14,965, out of which £12,500 was paid as dividend, being at the rate of 10%. H. Ewer Jones, the consulting engineer, reports that an increased amount of development work has been done during the year, and that the reserve has been substantially increased, being estimated on June 30 at 40,000 tons averaging 13 dwt.

**Mount Elliott.**—This company was formed in London in 1907 to acquire the copper mine of this name, situated 72 miles south of Cloncurry, North Queensland. At the advice of W. H. Corbould, the manager, the smelter was moved to a more convenient position, and the operations were re-started in September 1910. The report now issued covers the year ended June 30 last. During this period 42,616 tons of ore was smelted and the matte produced treated in the converters. The production was 5466 tons of blister copper containing 5412 tons copper, 9850 oz. gold, and 4440 oz. silver. In addition, the matte held over when the furnaces were moved was treated and yielded 284 tons of blister copper. The value of the production is given at £391,489, of which £232,283 has been received, the remainder not being actually realized when the accounts were closed. The cost at the mine and smelter was £135,547; the cost of freight and realization of the blister copper was £41,444; London and Melbourne office expenses were £5374; £20,000 was appropriated against the cost of moving the smelter; £10,654 was written off development account; and after taxes and several small items were paid, the balance of profit was £130,907. Deducting the debit from the previous year, the available balance was £114,439, of which the first dividend paid by the company absorbed £73,759, being at the rate of 10%. Mr. Corbould estimated the reserve on June 30 at 90,000 tons of 10 to 12% ore, and 125,000 tons of 3% ore above Level No. 4. Owing to the irregularity of the deposit, he is not able to give any estimate of the high-grade ore on Level No. 5. The exploration work by driving and diamond drilling shows that there are large bodies of low-grade ore on Level No. 5, averaging 1 to 3% copper. The report is not too hopeful as to the continuity of good quality ore in depth. Our Melbourne correspondent has, in recent issues, referred to this mine, and has urged amalgamation with the Hampden company, which has larger reserves of ore, but no capital and small facilities for smelting.

**Sulphide Corporation.**—This company was formed in 1895 by the Exploration Co., and Gibbs, Bright & Co., conjointly, for the purpose of acquiring the Central mine at Broken Hill, the zinc-lead ores of which were to be worked by the Ashcroft process. Subsequently this process was proved a failure and abandoned, and the control then passed entirely into the hands of Gibbs, Bright & Co. The sulphide ore is now treated for lead in the usual way, and the zinc tailing is beneficiated by the Minerals Separation flotation process. For many years the ordinary shares received no dividend, but the profits have been more satisfactory since 1908. The report now issued covers the year ended June 30 last. During this period 228,483 tons was raised from the mine and 226,768 tons sent to the lead concentrator, the average content not being given. The production of lead concentrate was 43,446 tons averaging 61·3% lead, 8·8% zinc, and 28·1 oz. silver per ton. The zinc tailing and slime amounting to 186,070 tons were treated by flotation and yielded 71,664 tons of zinc concentrate, assaying 42·7% zinc, 10·9% lead, and 14·7 oz. silver. The total recovery of the metallic contents of the ore by the two processes was 93·2% of the lead, 87·8% of the zinc and 90·2% of the silver. Toward the end of the financial year a de-leading plant started work on the zinc concentrate, and since then the zinc content of the concentrate has been raised to 46%. The smelting plant at Cockle Creek, where the lead concentrate is smelted, has suffered from foreign competition in custom ores. C. F. Courtney, the manager, estimated the reserve on June 30 at 2,656,400 tons, a decrease of 45,600 tons during the year. The developments at the 1100 and 1200 ft. levels are promising and exploration is being commenced on the 1300 and 1400 ft. levels. The sales of concentrate brought an income of £972,314, and the working costs were £823,555. After payment of administration, taxes, debenture in-

terest, etc., the profit was £179,448. Out of this £15,000 has been added to the reserve fund, and £144,375 has been distributed as dividend, being at the rate of 15% on both preference and ordinary shares.

**Kalgurli Gold.**—The property belonging to this company is situated at the northern end of the 'Golden Mile,' having as neighbours on the east, south, and west, the Hainault, Perseverance and Associated respectively. Operations commenced in 1897, and dividends were first paid in 1902. The most profitable year was 1906–7 when £210,000 was distributed. The report now issued shows that the grade of the ore is gradually decreasing. During the year ended July 31 last, 127,010 short tons was treated, yielding gold worth £299,619; the tonnage was practically the same as during the previous three years, and the yield compares with £332,522 in 1909–10, £346,386 in 1908–9, and £355,876 in 1907–8. After all costs, expenses, and taxes were paid and allowance made for depreciation, the net profit was £116,326, and, with £25,564 brought in from the previous year, the distributable balance was £141,890. Out of this £136,500 was paid as dividend, being at the rate of 22s. 9d. per £1 share. The average extraction during the year was 47s. 2d. per ton, as compared with 52s. 1d. the year before. Unfortunately the grade has still further decreased, and since the close of the company's financial year, the extraction has been 40s. 3d. R. S. Black, the manager, reports that the fall is due chiefly to the absence of rich telluride streaks that characterized the upper levels and those parts of some of the lower levels that were opened first. The recent development work has disclosed increased irregularity of the orebodies as well as irregularity of content, and though the ore disclosed is apparently similar in extent and content to that extracted during the year, Mr. Black is more averse than ever to committing himself to exact figures.

**Broken Hill Block 14.**—This mine is situated between the Broken Hill Proprietary and the British Broken Hill mines, and during the last few years operations have been confined to the removal of carbonate ore left in the upper stopes. Of this, 11,064 tons has been mined during the half-year ended September 30 last, averaging 29·67% lead and 16·11 oz. silver per ton. This was sold to the Proprietary company for £26,659. It has been decided not to mine the reserve of 220,000 tons of sulphide ore, at any rate at present. Six months ago the directors announced that they had asked for advice for the purpose of re-opening and improving the concentrating plant with a view of taking advantage of the present high prices of metals. Two factors in the situation, however, were against this policy. In the first place the plant would require too much expenditure to bring it to a state of efficiency after having been idle so long, and second the position of the reserve and the conditions of the stopes were such that the cost of mining would be too high. The directors report that 57,400 tons of accumulated slime was sold to the Junction North company during the half-year for £12,850 of which £5000 was paid down and the remainder is to be paid by instalments. The diamond-drilling work has not resulted in any new discoveries. During the half-year the Torrington wolfram mine in New South Wales was purchased, and a subsidiary company formed. Particulars of this property are given on another page of this issue. The profit for the half-year was £9511, and £10,000 was distributed as dividend, being at the rate of 1s. per share. F. Voss Smith is the general manager and engineer.

**Broken Hill Block 10.**—The output at this mine during the half-year ended September 30 has been restricted to a period of 18 weeks, as the concentrating plant was stopped at the beginning of August for a thorough overhaul and alteration, the recommendations of George Weir of the North Broken Hill mine having been adopted. It is expected that the renovated concentrator will be at work early this year. During this period, 33,831 tons of ore was mined and treated, assaying 13·77% lead, 16·5% zinc, and 14¼ oz. silver per ton, and of lead concentrate 5094 tons was produced, averaging 59·87% lead, 7·6% zinc, and 35·4 oz. silver per ton. The zinc tailing and slime amounting to 28,737 tons averaged 5·4% lead, 17% zinc, and 9 oz. silver per ton. This together with accumulated tailing and slime was sent to the De Bavay company's plant for treatment. The income from the current production was £37,301 from the lead concentrate, and £7351 from the zinc tailing. The working account showed a loss of £5789, a condition of things due partly to the closing of the plant and partly to the poor extraction. The company received also £4557 as final payment for a batch of old tailing, and there is also a credit item of £24,255, "By-products reserve account," so it has been possible to distribute £10,000 as dividend at the rate of 1s. per share and to write off £10,736 for depreciation. About £7000 has been spent on capital account during the year, chiefly on mill reconstruction. During the time that concentration is suspended, extra work is being done in mine development. Diamond-drilling has shown the orebody to persist in depth, so the main shaft is being sunk another 100 ft. to 1815 ft. The manager, V. F. Stanley Low, has resigned after 9¼ years service.

**Murex Magnetic.**—This company was formed in 1909 to work a concentration process invented by A. A. Lockwood. The process consists of adding magnetite or other magnetic substance to the ore, together with some liquid that will make the particles of magnetite and the sulphide or other mineral in the ore agglomerate together and form granules that are susceptible to magnetic influence. It is claimed that the process is effective under many circumstances when the flotation processes fail. We gave full details in our issue of October 1909. The report now issued covers the year ended June 30 last; completer information is however given in the chairman's address to the shareholders, which is reported elsewhere in this issue. We summarize the position briefly here. When the process was first started, arrangements were made to test it at Broken Hill Block 14 mine, where it was supposed that it would be welcome, as the sulphide ore is not being treated. But the mine did not give proper facilities for demonstration, so the plant has been removed to the Amalgamated Zinc (De Bavay's) where it will be worked and watched by certain parties who will acquire the Australian patent rights if the results are favourable. Another step in connection with Broken Hill is the financing of the South Extended mine. The reason for this policy is that otherwise there was no opportunity for applying the process in this district, owing to the metallurgical problem having been solved to the satisfaction of the various boards at all the other mines. The company with the help of friends has undertaken to subscribe for a maximum of £55,000 debentures in South Extended, to be paid by instalments according to the success of the development; £30,000 is to be spent for that purpose, and later, £25,000 on plant. The results of development work thus far obtained are reported as satisfactory, and large bodies of ore assay-

ing 24½% zinc, 11½% lead and 2·8 oz. silver have been proved. As regards the application of the process in other parts of the world, good results are reported from the Cordoba copper mine in Spain; details of this work are given in a review of the latter company's report on another page. The plant at Malines in France, where zinc-lead sulphide in a barite gangue is being concentrated, is now running continuously. The St. Christoph plant in south Germany has been closed, as the ore was found to be too low in zinc to be profitable. During the past year several important new contracts have been obtained. One is with the Prussian State in connection with a mine in the Harz mountains, where a finely disseminated lead ore intimately mixed with silica and barite is to be treated. A plant is being erected at the Mazapil mine in Mexico to treat a complex ore containing lead, zinc, silver, and iron; and another contract in Mexico has been concluded. The Whim Well copper mine in northern West Australia is being supplied with a plant that is to treat carbonate ore; if the process is as successful at the mine as it was on the sample, the beneficiation of carbonate ores in this way will mark a notable epoch in concentration. As regards the finances of the company, the working capital is supplied at present by loans from its supporters, and the time has not yet arrived when the royalties are of sufficient amount to warrant the presentation of a profit and loss account.

**Minerals Separation.**—This company owns the Sulman-Picard-Ballot and other patents for concentrating ores by flotation, and for some years has worked the process successfully at the Central mine, Broken Hill, belonging to the Sulphide Corporation. At the latter end of 1910 the process was adopted by the Zinc Corporation, of Broken Hill, as it was found cheaper to work and more applicable to the low-grade material and slime. The report now issued covers the year 1910, and the more recent information is contained in the chairman's speech which is reported in another part of this issue. The accounts for 1910 are notable, for they contain for the first time a profit and loss account, which shows that the company has now arrived at a profit earning period. The realized profit from royalties and treatment operations was £82,691. The directors have written off £54,100 for depreciation of plant and for expenses in connection with experimental work, so that from the beginning of 1911 the company could go forward without any encumbrance. It is noteworthy also that all debentures have been retired. Litigation expenses, £17,078, have been charged against the share premium reserve. John Ballot, the chairman, in his speech, alluded to the reason why the process had been adopted by the Zinc Corporation instead of the Elmore process, and showed that it was cheaper and more effective. He described in detail the application of the process to the treatment of slime. He announced that the company had just concluded a contract with a big South American copper mine, and that the subsidiary company formed to handle the process in America had done a great deal of useful investigation, and that there were prospects of securing profitable contracts. He referred to the doings of James M. Hyde, who, after the termination of his connection with the company, in February 1911, had seen fit to use the process in Montana independently, in defiance of the company's patent rights in the United States, and he announced that suit had been brought for infringement. These and other subjects were treated with great fullness and clearness by Mr. Ballot in his speech, and we refer readers to a summary published elsewhere.

**Ore Concentration.**—The report of this company controlling the Elmore vacuum concentration process covers the year 1910. It shows a revenue of £9438 from royalties, etc., and a balance of income over expenditure of £3183. The expenses in connection with litigation in Australia against the Sulphide Corporation, in which the company was unsuccessful, have not been charged against revenue, but placed to a suspense account pending the result of the appeal to the Judicial Committee of the Privy Council that is to be heard shortly. The report mentions that the 12-unit plant at Sulitelma, Norway, where pyritic tailing is treated, has been extended to 18 units, and that the 10-unit plant at the British Broken Hill mine is doing good work. An important mine in Mexico has increased its plant to 3 units, and two plants have been started in Canada. Applications have been filed for new patents, and it is hoped thereby to widen the use of the process.

# TRADE NOTES

*Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.*

**Merton Furnace Co.** report the shipment of a furnace to the Mawchi Tin and Wolfram Mines, Burmah. It will be used for roasting tin ore.

**Keystone Driller Co.** have issued a booklet which tells the story of the rescue of an entombed miner by means of four holes put down by a Keystone Drill at the White Oak Mine, Missouri.

**The Robins Conveying Belt Co.** have inaugurated a series of monthly publications for distribution among engineers and works-managers interested in the economical handling of materials by mechanical means. The first two issues are full of instructive matter, and it is surprising to find how many uses have been made of this device, and how widely the conveyor has been adopted in the saving of manual labour. The Robins Co. have adopted a broad-minded policy in giving minute details in regard to the design of their specialties, and they properly remark in the September issue that the time has passed for manufacturers to consider that the jealous guardianship of a so-called 'trade secret' is essential to success. Every mining engineer should make sure that his name is on the mailing list.

**Fraser & Chalmers** are distributing a 16-page bulletin describing the machinery required for a modern crushing plant. The requirements in recent metallurgical practice have revolutionized the methods of preliminary preparation of the ore to be treated, and this last bulletin indicates that Fraser & Chalmers are anticipating the general demand for more careful consideration of the crushing problem.

**Gillespie & Co.** have taken over the selling agency for the Parker rotary system of drilling for oil. Among the advantages claimed for this system are: economy in tubing (no casing is required during boring), and great rapidity in boring (a speed of 100 ft. per day being nothing unusual in a 2000 ft. bore). It is particularly adapted to the general conditions found in oil fields. No claim is made for its efficiency in hard or tough rock formation.

**The Ingersoll-Rand Co.'s** exhibit of Air Compressors, Rock Drills, Hammer Drills, and other pneumatic machinery was awarded the only Grand Prix at the Turin Exposition. The machines exhibited were of standard design taken from the regular European stock.

# The Mining Magazine

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*Scientia non habet inimicum nisi ignorantem.*

T. A. RICKARD, Editor. EDGAR RICKARD, Business Manager.

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# STATISTICS

### Stocks of Copper in England and the Continent.
Reported by Henry R. Merton & Co.

| | Nov. 30. Tons | Dec 31 Tons | Jan. 31 Tons |
|---|---|---|---|
| In England | 44,597 | 42,104 | 40,182 |
| In France | 5,485 | 5,254 | 5,488 |
| Afloat from Chile | 2,250 | 1,575 | 2,300 |
| Afloat from Australia | 6,350 | 8,350 | 7,600 |
| Total | 58,682 | 57,283 | 55,570 |
| In Rotterdam | 5,700 | 5,300 | 4,900 |
| In Hamburg (estimated) | 8,900 | 8,100 | 8,200 |

### American Copper Producers' Association.
In Tons of 2,240 lb.

| | Production. | Deliveries: Domestic | Deliveries: Foreign | Deliveries: Total | Stocks at end of month |
|---|---|---|---|---|---|
| January 1911 | 51,650 | 18,785 | 23,753 | 42,538 | 63,591 |
| February | 49,030 | 22,553 | 20,139 | 42,692 | 69,929 |
| March | 58,273 | 29,500 | 26,375 | 55,875 | 72,325 |
| April | 52,716 | 23,396 | 27,736 | 51,132 | 73,909 |
| May | 56,679 | 28,814 | 27,669 | 56,483 | 74,105 |
| June | 55,605 | 27,525 | 31,902 | 59,427 | 70,283 |
| July | 50,075 | 25,438 | 33,429 | 58,867 | 61,491 |
| August | 56,024 | 26,757 | 31,185 | 57,942 | 59,573 |
| September | 51,602 | 25,587 | 22,689 | 48,276 | 62,899 |
| October | 52,792 | 28,602 | 26,832 | 55,425 | 60,267 |
| November | 49,945 | 30,375 | 29,932 | 60,307 | 49,905 |
| December | 54,865 | 29,459 | 35,374 | 64,833 | 39,937 |
| Total, 1911 | 639,258 | 316,791 | 337,009 | 653,800 | — |
| January 1912 | 53,272 | 27,832 | 35,789 | 63,621 | 29,589 |

### Production of Gold in the Transvaal.

| | Rand | Elsewhere | Total | Value |
|---|---|---|---|---|
| | Oz. | Oz. | Oz. | £ |
| July 1911 | 679,881 | 29,377 | 709,258 | 3,012,738 |
| August | 682,405 | 31,002 | 713,407 | 3,030,360 |
| September | 669,773 | 30,852 | 700,625 | 2,976,065 |
| October | 677,923 | 30,721 | 708,644 | 3,010,130 |
| November | 291,466 | 28,267 | 719,729 | 3,057,213 |
| December | 680,782 | 29,126 | 709,908 | 3,057,213 |
| Totals, 1911 | 7,896,802 | 340,921 | 8,237,723 | 34,991,620 |
| January 1912 | 709,280 | 27,780 | 737,360 | 3,130,830 |

### Cost and Profit on the Rand.

| Month. | Tons | Yield per ton | Costs per ton | Profit per ton | Total profit |
|---|---|---|---|---|---|
| | | s. d. | s. d. | s. d. | £ |
| January 1911 | 1,865,232 | 26 6 | 17 11 | 10 1 | 930,059 |
| February | 1,712,198 | 28 0 | 18 3 | 10 3 | 874,612 |
| March | 1,960,678 | 28 6 | 17 11 | 9 9 | 949,415 |
| April | 1,926,583 | 27 7 | 17 6 | 10 1 | 971,858 |
| May | 2,002,926 | 27 7 | 17 10 | 9 7 | 956,823 |
| June | 1,986,559 | 27 6 | 17 11 | 9 8 | 960,381 |
| July | 2,095,220 | 27 2 | 17 10 | 9 4 | 969,687 |
| August | 2,107,809 | 26 8 | 17 9 | 8 11 | 967,457 |
| September | 2,037,329 | 27 4 | 18 1 | 9 4 | 952,665 |
| October | 2,083,900 | 27 0 | 18 0 | 9 1 | 948,278 |
| November | 2,089 387 | 27 6 | 18 3 | 9 3 | 965,729 |
| December | 2,030,439 | 27 11 | 18 4 | 9 7 | 967,897 |
| 1911 | 23,888,260 | 27 7 | 18 0 | 9 7 | 11,414,863 |

### Natives Employed in the Transvaal Mines.

| | Gold mines | Coal mines | Diamond mines | Total |
|---|---|---|---|---|
| January 31, 1911 | 183,268 | 8,357 | 9,991 | 201,616 |
| February 28 | 189,434 | 8,513 | 9,814 | 207,761 |
| March 31 | 193,457 | 8,493 | 10,061 | 212,011 |
| April 30 | 194,328 | 8,511 | 10,272 | 213,111 |
| May 31 | 190,392 | 8,379 | 10,425 | 209,196 |
| June 30 | 186,940 | 8,212 | 10,597 | 205,749 |
| July 31 | 181,582 | 8,122 | 11,054 | 200,758 |
| August 31 | 179,810 | 8,182 | 11,292 | 199,284 |
| September 30 | 179,619 | 8,045 | 11,475 | 199,139 |
| October 31 | 179,194 | 8,078 | 11,319 | 198,591 |
| November 30 | 176,736 | 8,043 | 10,071 | 194,850 |
| December 31 | 178,282 | 8,053 | 8,914 | 195,249 |
| January 31, 1912 | 184,046 | 7,805 | 9,524 | 201,375 |

### Gold Output of India.

| Year 1909 | Year 1910 | Year 1911 | Jan. 1912 |
|---|---|---|---|
| £2,083,901 | £2,104,858 | £2,150,050 | £185,955 |

### Production of Gold in Rhodesia.

| Month. | 1908 | 1909 | 1910 | 1911 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| January | 199,388 | 204,666 | 227,511 | 207,903 |
| February | 191,635 | 192,497 | 203,888 | 203,055 |
| March | 200,615 | 202,157 | 228,385 | 231,947 |
| April | 212,935 | 222,700 | 228,213 | 221,296 |
| May | 223,867 | 225,032 | 224,888 | 211,413 |
| June | 224,920 | 217,600 | 214,709 | 215,347 |
| July | 228,151 | 225,234 | 195,233 | 237,517 |
| August | 230,792 | 228,296 | 191,423 | 243,712 |
| September | 204,262 | 213,249 | 178,950 | 225,777 |
| October | 205,466 | 222,653 | 234,928 | 218,862 |
| November | 196,668 | 236,307 | 240,573 | 214,040 |
| December | 217,316 | 233,397 | 199,500 | 217,026 |
| Totals | 2,526,007 | 2,623,788 | 2,568,201 | 2,647,894 |

### Production of Gold in West Africa.

| Month. | 1909 Oz. | 1909 Value | 1910 Oz. | 1910 Value | 1911 Oz. | 1911 Value |
|---|---|---|---|---|---|---|
| | | £ | | £ | | £ |
| January | 22,817 | 91,112 | 17,357 | 70,699 | 15,903 | 66,107 |
| February | 21,403 | 86,210 | 16,976 | 68,469 | 15,179 | 63,081 |
| March | 23,186 | 93,556 | 17,627 | 71,954 | 16,387 | 67,673 |
| April | 21,491 | 88,071 | 16,363 | 67,069 | 17,237 | 70,880 |
| May | 25,104 | 100,056 | 16,590 | 68,355 | 24,427 | 96,409 |
| June | 17,340 | 70,561 | 17,194 | 70,988 | 22,555 | 92,174 |
| July | 17,331 | 70,523 | 15,564 | 58,551 | 22,510 | 91,955 |
| August | 17,766 | 71,614 | 13,921 | 57,713 | 25,385 | 103,753 |
| September | 18,125 | 72,963 | 11,497 | 47,746 | 26,717 | 109,039 |
| October | 15,957 | 65,813 | 13,341 | 55,046 | 26,826 | 109,503 |
| November | 17,882 | 73,824 | 14,021 | 57,658 | 24,289 | 99,299 |
| December | 17,570 | 71,332 | 15,042 | 61,737 | 24,369 | 99,569 |
| | 235,972 | 955,635 | 185,493 | 755,985 | 261,784 | 1,069 442 |

### Production of Gold in Western Australia.

| Month. | Export oz. | Mint oz. | Total oz. | Total value |
|---|---|---|---|---|
| | | | | £ |
| Total, 1910 | 363,496 | 1,209,856 | 1,573,352 | 6,682,042 |
| Total, 1911 | 160,021 | 1,210,447 | 1,370,468 | 5,823,522 |
| January 1912 | 10,697 | 95,673 | 106.370 | 451,828 |

### Other Australasian Gold Production.

| | 1909 | 1910 | 1911 | January 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Queensland | 1,916,468 | 1,840,337 | 1,623.390 | — |
| New South Wales | 869,546 | 803,727 | 769,353 | 54,821 |
| New Zealand | 2,006,910 | 1,896,322 | 1,808,049 | 144,067 |
| Victoria | 2,897,340 | 2,422,700 | 2,138,000 | |

### Sale of Tin Concentrate at Redruth Ticketings.

| | Tons | Value | Average |
|---|---|---|---|
| Year 1911 | 6151½ | £702,599 | £114 4 5 |
| January 8, 1912 | 253½ | £28,890 | £113 1 5 |
| January 23, „ | 216 | £25,122 | £116 6 2 |
| February 5, „ | 257¾ | £30,382 | £117 17 6 |

### Exports of Tin and Ore from Straits and Bolivia.
Reported by A. Strauss & Co.

| | Dec. 1911 tons | 1911 tons | Jan. 1912 tons |
|---|---|---|---|
| Metal from Straits to Europe and America | 5,765 | 55,135 | 4,018 |
| Metallic Content from Bolivia to Europe | 1,920 | 22,577 | 1,622 |

# REVIEW OF MINING

INTRODUCTORY.—The cold weather seems only to have condensed the gloom that oppresses the mining market. Business is unimportant and perfunctory. The little that is done is professional, for the public is keeping away. Scandals and rumours of scandals have intimidated the ordinary speculator. He is unwilling to play the game when the odds are so largely in favour of the dealer. Yet we see signs of betterment. Recently the price of Kaffir shares has strengthened. However over-rated they were a couple of years ago, or even six months ago, they have been lowered to a level at which in several cases the margin of income is big enough to cover the chance of something going wrong. All the mines are not managed like the East Rand and the City Deep; there are Brakpans, Modderfonteins, and Crown Mines. If bought on a speculative basis, these are now attractive. But it is no longer possible to regard any Rand share as gilt-edged. The gilt has been rubbed off the gingerbread, but the hazard is compensated by the big return, the risk is covered by the dividend; and on that basis the public may resume a buying more discriminating than heretofore. The Rhodesian market is still suffering from recent exposures and the best mines are still over-valued. West Africans are improving; several mines are on the eve of enlarging or resuming production, but it is well for the purchaser of shares to understand that the total cost of mining is likely to be under-estimated. Paris has been an important factor lately, selling Central Mining, Camp Bird, Esperanza, Mexico of El Oro, and other shares that were unloaded on our French friends during the boosting period. The Siberian group is well supported. Broken Hill mines are doing well. In Nigerian tin shares a lively market obtains, but the ice in some spots is thin, and speculators may shortly need a life-line.

TRANSVAAL.—The December output just failed to make a total of £35,000,000 for 1911. With 709,908 ounces, worth £3,015,499, the year's production amounts to 8,237,723 ounces, worth £34,991,620. This is, of course, the highest on record. As compared to 1910 the gain is £2,995,354, which is disappointing, having regard to the new big producers and the enlargement of many mills. The failure of several small properties and the scarcity of labour are the explanatory causes. For five months out of the last six the output has exceeded £3,000,000 and it is possible that 1912 may show a total of £36,000,000; but that is doubtful, making allowance for further likely failures on the part of mines that are being operated on an uncertain margin. The advancing cost of mining, due to increasing depth and labour scarcity, is likely to be a prominent feature in 1912. Despite a production that has grown by £3,000,000 the total of dividends is less. It is estimated at £8,100,000, as against £9,119,858 in 1910 and £9,504,621 in 1909. Labour statistics are slightly better. For all the mines the increase was 399 as against November, but for gold mines only the increase was 1546. The total for gold mines was 178,282, as against 178,602 in December, 1910. This is a poor result to show for a recruiting so strenuous as to have raised numerous protests. The stringency is greater than it was a year ago, because several large new mines have entered the productive stage. It is stated that the drought has affected the mealie crop, particularly in the Zoutpansberg and Rustenburg districts, in Swaziland also, and in Bechuanaland. If this be so, the natives will be driven to seek work, so that a larger supply of labour will be available for the mines.

The conclusions reached by the Government Commission on Miner's Phthisis are that no machine-drill miner employed for 16 years escaped the disease, and that only 50% of the hammer-men may escape under favourable conditions. The hopeful opinion is expressed, however, that improvements in preventive appliances are making real progress.

It is believed in well informed circles that the Central Mining dividend will be passed, the profit being used to write-down depreciated investments. This unfavourable incident has already been discounted.

The Witwatersrand Deep has been unfortunate in being flooded on the lower levels, but the boring at the 16th and 18th levels has yielded excellent results below the dike, to which is due the unexpected influx of water. The cores assay 12½ dwt. per ton over 5½ feet, and 10 dwt. over 4½ feet. Buying of Geduld shares from Johannesburg presages good news later on. The deeper workings of the Consolidated Langlaagte have added a large tonnage of good-grade ore to the reserve. The City & Suburban reports 1493 feet driven during the last quarter of 1911 in 25 inches of 13 dwt. ore. During the same period the Brakpan drifts were extended 1831 feet in 42 inches of 10 dwt. ore.

RHODESIA.—The December gold output was slightly better than in November, being 51,534 ounces, valued at £217,026. This came from 148 mines as against 168 in November. Thus the total for the year was £2,647,894, as against £2,568,198 in 1910, and £2,623,708 in 1909. The industry is stationary, as measured by production, despite all the loud talk about expansion. In December the Globe & Phœnix maintained the premier position with an output of 9647 oz., as compared with 8735 oz. in November. The Giant comes next with 4260 oz., against 4346 oz. in November. The latest reports from the Lonely Reef indicate satisfactory developments on the deepest levels. Mr. H. A. Piper's report is awaited with interest.

The Globe & Phœnix has suffered from rumours of a decreased dividend, but the official statement is that no reason exists for anticipating a decrease, if the labour supply continues reasonably good. As the financial year is closed, it might appear that a more explicit statement is justifiable. We note that the ore in reserve shows a slight increase at the end of the December quarter as compared with September. It is given as 173,613 tons averaging 37 dwt. per ton, or a 'gross value' of £1,348,973. 'Gross' should be 'assay.' For the three years 1908–1910 the actual cost was 40s. per ton, or 12s. 8d. more than the average 'working cost,' at 27s. 4d. per ton. In 1911 the cost was abnormally high. Allowing an extraction of 90% of the gold in the ore, the actual profit would be about 93s. per ton. Thus the ore in reserve promises to yield a profit of £807,300. The shares sell at £1⅞, for 800,000 shares, so that the mine is appraised at £1,500,000. The shareholder is assured the current rate of dividend, namely, £200,000 or 13⅓% per annum on the market valuation, for four years, but he is gambling with the whole of his capital. One feature in the December returns we note with pleasure, namely, that the assay-value is given in pennyweights and not in a fraction to three places of decimals, as heretofore. The meticulous fraction having been discarded, we hope that the assay-value of the ore will increase in whole units. If we criticize this company so often, it is because it is the most important gold mine in Rhodesia. It should be the examplar of correct method.

The Shamva has been the subject of congratulatory remarks on the part of those holding the shares. We do not detract from the achievement in so far as it refers to the rapid and inexpensive opening-up of a big orebody, but we demur to the financial inferences employed to boost the share quotation. At the

end of 1911 the reserve had increased to 1,808,000 tons, averaging 4·62 dwt. or 18s. 6d. per ton. The working cost is estimated, by Mr. H. A. Piper, to be 8s. 6d., provided the railway is extended to the mine. This proviso involves time, and possibly money. Some expenditure on plant will be necessary. All of the 4·62 dwt. will not be extracted, for a small loss in milling is not unusual. Besides the 'working cost' there are administrative and other expenses. In short, if the cost of turning the gold of the ore into bars of bullion at the London mint is less than 10s. 6d. we shall have good reason to express surprise. The profit to the shareholders is not likely to be more than 8s. per ton, or £723,200. It is true this does not exhaust the possibilities, but it does indicate the assured profit. More ore will be opened-up on the second level, and probably on the third, but the results obtained on the latter (or bottom) level are not wholly satisfactory. The assay-values reported from the southern cross-cuts indicate unprofitable rock, but the later news from the northern cross-cuts shows 2½ to 7½ dwt. ore. Nothing is said about the ore cut in the winzes sunk from the second level. The orebody is such as to be non-persistent in depth, but of large lateral extent. No reference is made to the present, and future, scarcity of labour. This mine must be worked on a large scale and will require plenty of labour. As we have said before, the Shamva is a tall gamble on a valuation of £4 per share or £2,000,000 for the property. The surveys of the Mazoe-Shamva railway are said to be completed and work is to commence at once. The distance is 48¼ miles.

One of the big lenses in the Cam & Motor has been cut in an eastern cross-cut on the No. 5 level, and where first penetrated it assays 11·2 dwt. per ton. This is highly satisfactory.

WEST AFRICA. The December statistics of the Chamber of Mines show that the gold output was 24,369 ounces, worth £99,569, or about the same as in November. The individual outputs exhibit some noteworthy differences, the Prestea increasing from £12,861 to £17,478, as between November and December, while the Bibiani and Broomassie show decreases, amounting to £3761 between them. The Prestea is still below its former average. The total production of the Gold Coast in 1911 was £1,069,442, which is £313,457 better than 1910, but £116,900 less than 1908.

The Ashanti Goldfields announces the finding of a highly promising vein in the Tom Collins prospect. At the Ashanti mine itself, on the No. 10 level, the lode recently intersected has proved 27 feet wide, with coarse gold on the hanging-wall, while the rest of the quartz assays 6 dwt. per ton. We commend this manner of stating the character of the lode; if the thin seam on the hanging had been mixed with the rest it is obvious that a high, but probably misleading, assay could have been recorded.

The Ancobra Dredging Co. reports one of its dredges as idle, owing to a broken tumbler. We regret to hear that Mr. S. J. Weis, a most competent man for this work, is not likely to remain in charge.

Reference is made at length elsewhere to the Nigerian tin industry. We note with pleasure that the Jos Tin Area, in giving the January production as 29 tons and shipments at 42 tons of concentrate, also adds a foot-note stating that the average content is 74¼% metallic tin.

AUSTRALASIA.—The Broken Hill Proprietary has made a beginning of marketing its zinc products by selling zinc-dust to the cyanide plants at Johannesburg. During November and December the Broken Hill mining and metallurgical companies distributed £425,993 in dividends. The Sulphide Corporation leads with £144,475, then come the Proprietary with £48,000, the North with £35,000, and the British with £30,000. In 1911 the Broken

Hill mines made a record production. The total tonnage of silver, lead, and zinc products was 736,110, valued at £3,110,109. The North Broken Hill will shortly pay the usual 4s. dividend and it is obvious that the profits justify a further distribution. The British can pay a 2s. dividend or begin the redemption of the debentures. The managing director, Mr. W. H. Woodhead, is due to arrive from Australia. The Great Fitzroy is likely to be reconstructed shortly. The Mount Elliott and Hampden Cloncurry mines are being sampled preparatory to a consolidation. At Mount Morgan a re-organization of the copper-smelting department has been found necessary. Under the general management of the late Wesley Hall a great deal of money was spent unproductively in faulty smelter equipment. Fully £75,000 will now have to be expended in rectifying mistakes. The services of Mr. J. Audley Smith have been retained for this special purpose, and he is to be assisted by Mr. A. L. Dean, of Mount Lyell.

INDIA. — In Carmichael's section of the Champion Reef mine, two winzes that have been sunk from the bottom or 41st level to a point where the 42nd level will be begun are in ore assaying 2 and 2¼ oz. respectively over 15 inches, so the prospects for the 42nd level are promising. The developments in Ribblesdale's and Tennant's sections at the Mysore mine continue to be excellent. At a number of points the assays give pleasant reading for the shareholders; for instance 2 oz. over 2 and 3 ft., 32 dwt. over 6 ft., and 23 dwt. over 3 ft. A spark of comfort has been vouchsafed to the shareholders in Balaghat by the discovery of 2-oz. ore in a rise above the 1350 ft. level.

The development work at North Anantapur is giving some gratifying results. In a drift on the 450-ft. level north, a body of ore 5½ ft. wide assaying 2 oz. per ton has been struck. Several other discoveries of an encouraging nature are reported, pointing to the continuity of the orebody.

After giving disappointing results at depths from 1340 to 1740 ft., the Hutti (Nizam's) mine in Hyderabad shows signs of regaining its position as a gold-producer. An ore-shoot has been traced from the 1840-ft. to the 1940-ft. level; the extent and value of it have not yet been fully ascertained. On the lower level it has been proved for 149 ft., and both the ends are in good-grade ore. At one point the assays gave 1 oz. across 12 ft., and at another 2 oz. across 2 ft. These discoveries will encourage the directors to commence the sinking of the new shaft recommended recently by the manager, Mr. F. W. Grey.

MEXICO. — Our Mexican correspondent's letter will be found interesting. When he wrote, the Zapata movement was not serious, but early in February it led to unpleasant incidents at Cuidad Juarez, which is separated from El Paso by the Rio Grande. Newspaper accounts may safely be discounted, but widespread unrest still exists in Mexico and the Madero government is on its mettle. Any weakness will plunge the country into another revolution; for the present there is no cause for anxiety.

The controversy over the *avio* contracts threatens to make litigation, if no other trouble, for the Santa Gertrudis, at Pachuca. Reference to these old agreements has been made repeatedly by the chairman of the holding company, the Camp Bird. Proceedings were started in July 1911, by some Mexican shareholders, representing 6800 shares out of 12,800 shares in the plaintiff company, the Mexican company that formerly owned the Anistad and Concordia claims, now part of the Santa Gertrudis property. The matter came up for a hearing at Pachuca on December 13 and the District Court set aside the objection of the defendant that the number of shares held by the *aviadores* did not entitle them to bring action. The real issue, however, has not yet been tried, and will come before the Federal Court in due course,

that is, not before six months at least. Meanwhile the Camp Bird shareholders have the assurance of eminent American and Mexican counsel that there is no cause for anxiety as to their title in the Santa Gertrudis mine.

Mr. H. A. Titcomb's report on the Esperanza has been completed, and he is on his way home. The report ought to be issued soon. According to the secretary's circular, the developments on the San Carlos vein on the 11th level are most gratifying. For 300 feet of drift the ore is from 2 to 6 feet wide, and assays from 1 to 3 oz. gold per ton. Winzes and rises have been started and confirm the evidence of the drift that a valuable orebody has been disclosed.

The Tominil had a pleasant annual meeting, the chairman being able to state that the profit-earning stage has been reached. It is a pity that Mr. Gerald Browne, the consulting engineer, was not present. Mr. Henry Cribb is the new manager. We note that the January profit is given as $33,000, "say £3370." Evidently the first figure is in pesos, not American dollars. We advise the Tominil company to use the word 'peso' for the Mexican dollar, and avoid possible misunderstanding.

Shares of the Lucky Tiger-Combination Gold Mining Co. have been introduced on the London market. This is an Arizona corporation owning a well-known mine in Sonora, Mexico. The personnel of the London board gives no assurance of experience in mining affairs and the only opinion quoted is that of the president of the American company. This may be interesting to his friends, but it is inadequate for London speculators. A report by a reliable engineer is essential.

UNITED STATES. — Our correspondents send plenty of timely comment. The copper statistics are again good, showing a diminution of 10,000 tons in stocks.

The Portland, Golden Cycle, and Stratton's Independence companies at Cripple Creek are making a united effort to stop 'high-grading,' that is, ore stealing. The three companies have successfully petitioned the Federal Court for an injunction restraining the 48 'fences,' or assayers acting as receivers of stolen goods, from buying ore and allied products from the miners in the district.

RUSSIA.—Mr. C. H. Munro has resigned as manager for the Orsk Goldfields and is succeeded by his assistant, Mr. W. H. Lanagan, a thoroughly capable man. The dredge, it will be remembered, made a good start at the close of the last season, and will resume operations in the spring. It remains to be proved how correct were the estimates on which the dredging scheme was planned. No report on this subject by Mr. Munro has been published, but it is unlikely that he failed to express an opinion to the board of directors.

The Kyshtim Corporation produced 5144 long tons of copper during the year 1911. For December the output was 694 tons. The ore proved is estimated by Mr. R. Gilman Brown to be 1,800,000 tons containing 3·1% copper. This is equivalent to 55,800 tons of metallic copper, worth £85 per ton (in Russia) less a working cost of £34 per ton, leaving an estimated profit of £51 per ton, or £2,845,800. To this must be added the gold content, which can be taken at an average of £12 per ton of copper. The gold content in the ore, which is massive pyrite, is fairly regular, and the variation of gold per ton of copper is due to the greater degree of variation of the amount of chalcopyrite in the pyrite. When the above estimate was made the price of copper in London was £58 per ton.

SILVER. — The market for this metal is strong. On January 30 the price was higher than at any time since January 7, 1908. This is due to the Indian demand and to prospects of a better market in China. Any continued improvement will tend greatly to encourage silver mining, which has so long been depressed by the low price.

# EDITORIAL

GOLD RESERVES will not be abolished by the vote of shareholders in public meeting, for the cautious manager always keeps a reserve: if not bullion or amalgam, the broken ore in the mine or a rich stope on which he can draw to sweeten his returns. But the abolition of the official gold reserve will withdraw sanction for the faking of the output figures, and by that much, bring us nearer to mental honesty in mining affairs.

WHEN recently we heard one mine operator, identified with one fiasco, criticizing another mine operator, identified with another fiasco, we recalled Kipling's saying, in 'The Honours of War': "When he took breath, I realized how only Satan can rebuke sin. The good don't know enough." That is why clergymen, schoolmasters, and military gentlemen are helpless shareholders. "They don't know enough."

IN THE ACTION brought against the Rhodesian Exploration & Development Co. in regard to the purchase of the Elumba claims, it is recorded that Mr. H. G. Latilla, a prominent director, on being asked if he had consulted the plans of the mine, replied: "No. In the first place, I do not understand plans properly." In other words, a man who cannot understand the plan of a mine undertakes to act as trustee for shareholders. He is as useful as a general who cannot understand a topographical map.

AMONG the lessons given at the Royal School of Mines should be one or two on the art of cabling mining news. It is an art, not a science, and is naturally divisible into two parts: (1) How to convey information explicitly, and (2) how to go through the motions of giving information without saying anything significant. While not without experience both in cabling and in mining, we often find it impossible to decipher the meaning of some of the cablegrams ostensibly forwarded for the enlightenment of shareholders

ONE of those one-eyed leaders of the blind that write letters to the financia Press has stated recently, in speaking of the Rand: "An industry at present making £36,000,000 a year (which will increase) is not yet played out, &c." This is on a par with the talk of 'value' in regard to the assay-contents of ore in a mine. If the Rand mines were "making" £36,000,000 we should all be most happy; the fact is that they extract £35,000,000 worth of gold per annum out of the ground, and by this operation make £7,793,000 in dividends for the proprietors.

SEVERAL financial papers publish periodical tabulated statements showing the investment value of the mines of the Rand, with "timely calculations which will enable the exact aspect of each security to be adequately estimated by the investor." In these tables "the declared profit for 1911" is given, presumably to guide "the investor." This 'profit' should be omitted, or, if given, it should be accompanied by the figures giving the true profit, namely dividends and increases of cash on hand. Of the so-called profit only from 70 to 80% ever reaches the shareholders, the remainder going to expenditure on equipment, depreciation, taxes, and administration

BEARS are usually considered disagreeable beasts at close quarters. In finance they stand as the synonym for sinister depreciation. At the East Rand meeting, how-

ever, another aspect of ursine conduct was presented. According to one of Sir George Farrar's critics, the British public would have lost £25,000,000 if the bears had not, "by an intelligent anticipation of events," disclosed unpleasant facts, presumably hidden by those in control. Some truth underlies this humorous suggestion. If some operators did not make it their business to detect 'irregularities' and to anticipate the effect of unexpectedly unpleasant mining developments, the public might have to wait longer for their disillusionment. The groups would be both 'bears' and 'bulls,' playing the market both ways, with the public in the middle.

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TITLES, and especially the higher knighthood known as a baronetcy, have been cheapened of late by being conferred upon mining operators, to some of whom is denied the claim of being *sans peur et sans reproche*. However, the occasion may arise for honouring a man who has performed a distinct public service, and then we recognize the usefulness of titles. Such an occasion has arisen. We note with keen pleasure that "the King has been pleased to confer a baronetcy of the United Kingdom upon John Henniker Heaton, Esq." However desirable the honour thus accorded, Mr. Heaton has another even greater honour in the gratitude of millions to him for his persevering efforts in the cause of postal reform. By his practical and successful advocacy, first of Imperial penny postage, he helped to link British dominions by the golden thread of commerce, and then by an equally successful propaganda in favour of penny postage with the United States, he placed the whole English-speaking races under an obligation that they will be glad to remember. Sir John Henniker Heaton is a public benefactor far beyond the donor of libraries or even the giver of princely sums of money to charities; he has furnished fresh avenues of commerce, he has forged new links of good-will, he has increased the fraternity of the English-speaking races.

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IN the current bulletin of the Institution we note the continued discussion of Mr. H. S. Ball's paper on 'The Economics of Tube-Milling.' Among the contributors is Mr. S. J. Truscott, who submits a scholarly criticism, showing that he has studied the paper carefully, with the result that he proves the existence of a number of serious errors. These errors vitiate the author's conclusions, and render the paper not only valueless, but essentially dangerous to anyone who may have missed the corrections furnished by Mr. Truscott. Others equally sound are offered by Mr. A. W. Allen. Some of the errors are due to bad proof-reading and typographical slips, but many of them are fundamental. The curves are drawn with a freedom that disdains facts. We have ourselves noted that the author's thesis is claimed by him to find "striking corroboration" on a final figure of 14%, which on examination, it is ascertained, should be 6%. Mr. Truscott ends his contribution to the discussion with a modest hope that he has not gone too far, and with a kindly regret that he has been impelled, in the interest of technical science, to be destructive. Naturally, destruction is unpleasant, but it is often essential to real progress. Honest criticism is rare, especially before professional societies, where amiability dominates, but it is obvious that it is one of the most useful functions of such a society. The proceedings of the Institution will gain more from such criticisms as those of Sir Thomas Holland, Mr. Truscott, and Mr. Allen than from half-a-dozen mediocre papers.

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THE UNSAVOURY scandal of the Amalgamated Properties of Rhodesia was not disinfected at the recent meeting. This was a pitiable farce and served merely to exhibit the helpless stupidity of shareholders. The new chairman inspires no confidence

The suit against Sir Abe Bailey is most useful in giving legal sanction to a reticence that forbids the furnishing of real information to the shareholders. The only redeeming feature is the addition of Mr. Arthur Dickinson to the board of directors. Mr. Dickinson is a mining engineer of high repute, and we only wonder how a professional man of his calibre was drawn into the mess. But it is a step in the right direction, and the only one. If every mining company had among its directors at least one experienced mining engineer detached from share-dealing and promoting, the public would have more effective protection than it will ever obtain from reports, meetings, and circulars.

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AMONG the papers that purport to guide the public in mining speculation is the *Sunday Times*. We read it, not for its mining news, but for the golf articles written by Mr. Bernard Darwin, a grandson of Charles Darwin and an inheritor of his powers of observation. Incidentally we glance at the columns devoted to the financial gossip of the week. Of course, the *Sunday Times* is in no way related to *The Times*. That is evident to him who reads the mining causerie appearing in the Sunday paper. It is obviously interested in Rhodesian mines, which it has vainly tried to boost. Sir Abe is the god of its weekly idolatry. The vacant pedestal is still honoured. However, we mention these details before referring to the paragraph anent the Alaska Exploration Co.'s prospectus. It is related by the scribe in the *Sunday Times* that "there are altogether 80 dredges working in the different parts of Alaska, of which 60 belong to one group, who last year took $25,000,000 gold out of the ground." If this be true, a big error has been made by Government statisticians. The whole of Alaska yielded $16,271,000 in 1910, and $16,003,000 in 1911. The largest number of dredges operated by any one company in Alaska is three. All the dredges in operation in Alaska will not total more than 30. Possibly reference is intended to the Yukon Gold company, operating in the Klondyke district, which is in the Yukon territory of Canada. This company produced $2,847,098 in 1910, employing 7 dredges.

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### Bessemer Memorial.

On January 30 the equipment of the Bessemer laboratory was formally presented to the Royal School of Mines. In the first issue of this magazine we chronicled the ceremony with which King Edward VII. laid the foundation stone of the new buildings on July 8, 1909. One event supplements the other, and both together mark an important step in the progress of technical education. On June 29, 1903, a meeting was held at the Mansion House with a view to commemorating the beneficent work of Sir Henry Bessemer. An influential committee was formed, an appeal for subscriptions followed, and it was decided that the memorial should take the form of mining and metallurgical equipment for the Royal School of Mines. At that time the School was undergoing a systematic re-organization and it had already been planned to make it an integral part of the proposed Imperial College of Science and Technology. In 1902 a protest started by a student, Mr. W. S. Lecky, had drawn the attention of old graduates and others interested in the welfare of the School to undoubted deficiencies in the educational scheme, but as early as 1900 the Institution of Mining and Metallurgy, by its council, had taken steps toward the same end, and in 1901 a committee had been appointed to inquire into the subject. Public criticism tended to accentuate the need for this inquiry, which was accorded respectful attention at South Kensington. The secretary of the Institution was the secretary of the Bessemer Memorial Fund; thus the effort to raise money for a laboratory went hand in hand with the wider purpose of improving the position of the Royal

School of Mines, which had been driven from pillar to post during the half-century of its useful existence. The result of these public-spirited efforts is obvious. Go to South Kensington: *Si monumentum requiris, circumspice.* The outward and visible sign in the shape of well equipped laboratories placed in a suitable building is there; no less substantial is the fact that the Royal School of Mines constitutes an integral and important part of the new Imperial College of Science and Technology. Even those among the alumni to whom the identity of their school seemed in danger of being lost amid a departmental shuffle must now admit that the Royal School of Mines has suffered kindly at the hands of its friends, official and non-official, and emerges better equipped, more firmly established, and, we believe, more fitted to fulfil its mission as a training college for the young citizens of a world-wide mineral empire. Sir Julius Wernher and the late Alfred Beit provided a large portion of the money required for the Bessemer laboratories; Hennen Jennings, as a member of the Government committee, contributed a painstaking and effective interest in the educational improvements; Mr. Walter McDermott gave freely in time, trouble, and experience to the arrangement of the machinery; and Mr. Charles McDermid, from first to last, gave energetic and devoted service to the work of raising the money and to organizing the various committees.

One word may be added. In reading the accounts of the brief ceremony that marked the presentation of the Bessemer laboratories by the Memorial Committee to the Governing Body of the Imperial College, we find references made by the daily Press to the practical character of the training now assured to the students in the Royal School of Mines. No bigger error can be made—and it has often been made elsewhere—than to suppose that a practical training is obtained by the use of model apparatus (even on a working scale) or by the amateur performances incidental thereto. The Bessemer plant will serve to illustrate the principles of mining and metallurgy as elucidated by the teaching of the lecture-room; it will help the student to visualize the larger operations of the mine, mill, and smelter; it will add a new interest to the descriptions given by the professors. But it will not train any young man in the practice of mining and metallurgy; for that he must go far from the laboratory; for that he must serve an apprenticeship amid the stern realities of money-making industry. And in laying stress on the true purpose of the new equipment we are glad to remember that facilities have also been created for the apprenticeship that follows the technical training and precedes the larger responsibilities of an engineer's career. The scholarships given to promising students, and the opportunities offered by representative firms for post-graduate courses now assure the eager beginner such a start in life as will supplement the usefulness of the Bessemer laboratories. This constitutes one of the principal results accruing from the intelligent interposition of the council of the Institution. With good teaching, ample laboratory illustration, and the chance of an adequate apprenticeship, the earnest student at the Royal School of Mines is afforded a fine opportunity to prepare for a successful and useful career. It remains for him to seize that opportunity and to crown it with honourable achievement.

## South African Steel.

Much interest has been aroused in English and South African circles by the issue of the prospectus of the Union Steel Corporation of South Africa, which made its bow to the public early this month under the patronage of Messrs. Lewis & Marks. The plan is to establish a plant for making steel at Vereeniging, 30 miles south of Johannesburg, where coal and fire-clay are abundant, and where

the electric current will be obtainable cheaply. The intention is to start with the manufacture of tool-steel, especially drill-steel, from scrap obtainable locally, and at first sight the Government contracts in connection with the supply of scrap and the favoured rates for freight may seem to promise good results for both the investor and the user of tool-steel. But there are several reasons why the issue should be received with caution. In the first place the project is being started before the services of a thoroughly competent Sheffield steel specialist have been secured. The prospectus certainly states that negotiations toward this end are in hand, but there is many a slip, as the proverb says; and in the absence of the name of the contemplated manager we have no means of judging of the wisdom of the choice. Another objectionable part of the prospectus is the statement that Mr. H. H. Wright, the discoverer of the Magnet Heights deposit of iron ore, has undertaken to hand over to the corporation his rights "if any" in the deposit. Seeing that the smelting of these deposits apparently constitutes the ultimate object of the corporation, the airy "if any" is not likely to inspire confidence. From the more general point of view we consider that the Government control will be of no assistance in a commercial venture of this sort, rather the reverse. It is indeed a matter of public notoriety that a scheme on similar lines, initiated by people thoroughly intimate with steel problems, was recently abandoned because of the intolerable terms and restrictions proposed by the Government. It would have been far better policy on the part of the authorities to encourage some Sheffield firm of established reputation, such as Osborn, Hadfield, Edgar Allen, or Firth, to inaugurate a local tool-steel industry, instead of handing the monopoly to a group with no experience in these matters. We cannot emphasize the fact too strongly that all the experience accumulated at Sheffield during many years is necessary for the successful production of tool-steel. It is obvious that if mistakes are made at first, and an unsuitable steel is offered to the mines on the Rand, the new South African industry will suffer incalculable harm.

## Great Cobar.

The Great Cobar has been the subject of acrimonious discussion in the Australian Press. We are glad to hear that Mr. H. C. Bellinger has been asked by the directors to remain in charge and he will do so for six months at least. Whatever disappointment has ensued from the larger scheme of operations, it is only fair to say that the labour conditions have been a large factor in preventing the attainment of the expected results. The general prosperity of Australia has lessened the number of men available for employ. An effort was made to import miners from America, but it failed. Since then an adequate supply has been promised from Cornwall. Evidently they have not arrived, as the current monthly report makes complaint of a continued shortage. The men are now paid 10s. 6d. per shift, but most of them are able to work on contract, by which they can earn 15s. per day. Formerly the rate at Great Cobar was 10s. 4d., while Mount Elliott offered 14s. 6d. and necessarily diverted the local supply. The increase in labour and in the price of supplies has raised the cost of mining to 9s. 5d. per ton, but this includes expenditure for development that should have been done three or four years ago, and it includes the cost of 'recovering' some stopes that were 'lost' before the present management came into control. The cost of smelting, as shown by treating 35,000 tons of ore per month, is 6s. 8d. per ton, with an addition of 1s. 2d. for converting. At the back of the failure "to make good" it must be recognized that the prospectus estimate of the total operating cost of 4s. per ton raised expectations incapable of fulfilment. When Messrs. Kendall,

Rolker, and Barnett examined the mine, in 1904, they appear to have erred in placing the cost of mining at only 40% more than that obtaining at Ducktown, Tennessee, where an orebody of similar character and shape is exploited. There the cost of mining is only 4s. per ton, but this is done with a plentiful supply of efficient coloured labour and under economic conditions otherwise more favourable. The total operating cost of 21s. to 22s. per ton at Great Cobar compares favourably with Mount Elliott and Mount Morgan, and the fact would be appreciated if higher expectations had not been raised. Moreover, the mine was taken over on an estimated yield of 3·15% copper, the reports of the gentlemen mentioned giving averages ranging from that figure to 3·7%. The yield has been 1% less, but allowance must be made for the addition of silicious ore from the Cobar gold mine. For the general disappointment Mr. Bellinger may not be held directly responsible, but it must be recognized that before he took charge of the mine he examined it and endorsed the sanguine views of those who controlled the company. Finally, it is proper to point out that two years elapsed between the inspections made by the engineers mentioned, and that during the interval the mine was partly gutted, being robbed of its richer ore and left in a bad condition. The delay in the transfer of the property was due to adverse financial conditions in London and the consequent trouble in raising the capital necessary for the new company.

## Tin Mining in Nigeria.

The interest taken in Nigerian tin ventures is in strong contrast to the generally depressed condition of the mining market. From 2 to 2½ millions sterling has been raised for tin-mining and prospecting enterprises in Northern Nigeria, and it is a fact that company-mongering, with over-capitalization, has been a marked feature of recent Nigerian mineral development. Moreover, most of the mines are, as yet, small affairs. But among the most successful are several syndicates that started with a trifling amount of capital and considerable experience in mining; and it is right to quote the instances in which moderation has been conspicuous. The Rayfield Syndicate is a notable example. The capital is £20,000 in 80,000 shares of 5s., but 40,000 of these shares were issued at 100% premium (or 10s. per share) and of this £15,000 is uncalled. The results obtained have been highly gratifying to the subscribers, sixpenny dividends having been paid monthly since October last, and at Christmas a bonus of 1s. per share was added. The Syndicate originally acquired five properties known as Shen, Lafon, Delimi, Wono, and Kuru. The Kuru was sold to the South Bukeru Company for cash and shares. Subsequently the Syndicate secured a property now known as Sabon Geri, and it bids fair to become one of the romances of mining. Situated within a dozen miles of Naraguta, the tin-bearing richness of the streams and banks appears to have escaped the serious notice of the early prospectors. The richness and extent of the deposits has been confirmed by reputable engineers, and the further evidence of veins remains to be tested. The Rayfield Syndicate is an example of a sane and successful mining adventure. Another undertaking is the Nigerian Tin Corporation, which conducts a general mining and finance business; it has four productive properties, securities of the quoted value of £18,000, some £15,000 in cash, loans, and tin in transit, and other share interests. As the subscribed capital is only £45,782, the directors appear to have acted discreetly, and to have had their share of good fortune. A dividend of 10% was paid in February 1911, and 71 tons of tin was produced by calabashing alone to December 31, 1911. Sluicing plant is now ready for operation, and a greatly increased yield is anticipated. The

Northern Nigeria Mining & Exploration Co. has a nominal capital of £10,000, of which £8838 has been issued; £6000 has been repaid in a dividend, and the company now owns areas of approximately 18 square miles.

Despite errors of finance, and other initial mistakes, the Nigerian tin-mining industry is prospering, as is proved by the distribution of substantial dividends. Out of 26 companies whose shares are quoted there are 20 with an aggregate nominal capital of £2,176,000, of which £1,888,734 has been issued. To these must be added 5 finance companies with a nominal capital of £640,000, of which £535,782 is issued. Another important group is that of the small syndicates, of which there are 25, with a total capital of about £250,000, or only £10,000 apiece. Only four of these companies were organized more than two years ago, the remainder seeing the light in 1910 and 1911, yet five have paid dividends and seven more are earning the profits that presage a dividend. Despite the vagaries of promoters, supported by optimistic stories, the results to date are encouraging. At least six concerns are likely to make money: the Bisichi, Rayfield, Naraguta, Kano Tin Areas, Jos Tin Area, and Tin Areas of Nigeria, although the last mentioned may need to be re-organized shortly. During the past year the total output is estimated to have been 1700 tons of concentrate, assaying 70% tin. While the published returns are defective in being given in terms of a variable concentrate, and not in metal, it is a fact that the average grade of the product shipped to Liverpool and to Cornish ports is high, ranging usually between 70 and 74%. However, some of the so-called tin reported has been a low-grade concentrate, and this fact has tended to throw doubt on current statistics. As hand-washing is succeeded by systematic hydraulicking the output will increase, so that for the current year we anticipate a notable improvement. The high price of tin has synchronized with the beginning of the Nigerian operations and it looks as if the market would continue favourable. A note in regard to labour may be added; for Nigeria like the rest of the world, has been threatened with labour scarcity. It is claimed that the insufficient supply that handicapped mining operations in December and January is temporary, being due to the demands of railway construction. The gradient of the railway to Zaria being in course of completion, the natives in the tin region were recruited to finish the part of the line that crossed the district to which they belonged. No less than 20,000 men were thus employed. Most of these will be released shortly. Meanwhile the completion of the railway will expedite work and cheapen transport. At present the tin concentrate is carried in bags on the natives' backs; it requires 32 of them to transport one ton; thus the operation of the railway will also release many carriers for other forms of productive labour. On the whole, this is for the moment one of the most cheerful spots on the mining horizon.

## The Helpless Shareholder.

An Irish shareholder writes to *The Financial News* to say: "If the East Rand meeting has proved anything, it is that of the absolute impotence of unorganized shareholders." We agree. They will remain impotent so long as they place their money in enterprises over which they can exert no control without first damaging the market-value of their holdings. In attending the annual meetings of mining companies we note that the shareholders present are loth to criticize the directors or to assent to any real investigation of affairs because anything of the sort will depreciate their shares. The average shareholder appears to say to himself: "Of course, I see that I have got into a poor thing; I paid too much for my shares; the mine is not what it was cracked up to be; but what is the use of making a fuss

or raising a scandal; if I do, or if others do so, the shares will go down further; obviously, the only safe course for me, and for others like me, is to keep quiet. This trouble will blow over, these disclosures will be forgotten, and whenever the shares have a bit of a rise, I'll find some duffer more simple than myself to whom I can sell my shares." Hence the chairman has an easy time, unless a 'bear' begins to growl. If he does, the shareholders howl him down, because he is depreciating their already depreciated property. If the adverse criticism, fully warranted, does not emanate from a bear, then it comes from a solicitor or a broker anxious to win self-advertisement in the financial Press. Hence the real shareholder and the intelligent man with a just grievance hesitates to address the meeting. While he hesitates, a friend of the board interjects some soothing remarks or offers criticisms so fallacious as to render it easy for the chairman to score. The proceedings exhibit signs of wire-pulling. Other arrangements are made for make-believe objections and protests. At a recent Glasgow meeting it was arranged that four gentlemen should proceed from London and go through the motions of voicing the claims of dissatisfied shareholders. They played the part successfully. The meeting endorsed the action of the directors. It is to laugh. Shareholders with small holdings are impotent and will remain impotent until they insist on one director, at least, being independent of the controlling groups. Mining engineers of experience, retired from ordinary practice and of known character, are suitable for this purpose. They could represent the public interest, as distinguished from the insiders; they could be given a watching brief, and to them the small shareholder could look for protection. We said that the public will be impotent until they "insist" on some such safeguard. They can only "insist" by abstaining from subscribing in any way to enterprises refusing them such protection.

**Rhodesia Exploration.**

We went to press in January just before the Rhodesia Exploration meeting. At this meeting the proposal to amalgamate with the Gold Fields Development Company was passed by the shareholders present. The proceedings were of the usual kind. It was obvious, for instance, from the splutterings of an elderly gentleman who sat next to the writer, that the shareholders did not want a fuss or a scandal; they might suspect that Sir Abe Bailey, Dr. Hans Sauer, and possibly other directors, had left them in the lurch; and they might have a sneaking idea that their property was not quite as valuable as they had thought when they bought their shares; the fact remained, however, that they were in, and in order to get out they must keep quiet and hope for a better day when someone more gullible even than themselves would take the shares off their hands. Such a background of confused thinking helps the chairman of a meeting when he has to begin like a beaten general with "I regret to say." Mr. Walter Forbes made a disarming speech. Mr. H. G. Latilla made a smart one, totally unconvincing to us, as a detached spectator of the game, but calculated to draw an aniseed bag across the trail of Sir Abe Bailey's flight. Then arose a clever little talker, Mr. W. Spencer, who spoke so frankly as to cause the directors to smile a ghastly kind of smile and wonder where he would stop. However, even he helped them by serving as a safety-valve for the disgruntled and suspicious among those in attendance. We note that Mr. Spencer's speech as published underwent a little delicate pruning, for we heard him endorse the new directorate by saying that the shareholders wanted capable men who would "manipulate their assets." That, we presume, must be taken in a Pickwickian sense, but it was in harmony with the rest of a cynically frank discussion of affairs. The avowal by Mr. Latilla that his former patron, Sir Abe

had sold every share, caused some surprise, but less than might have been expected. Obviously, the shareholders thought that the exchange of Lord Harris for Sir Abe was all to the good. So do we. After the amiable anxiety expressed concerning Dr. Sauer's health and the regret that therefore he should have been compelled to resign, the statement that he had also sold all but 1690 shares came as a grim anti-climax. Of course, shareholders may choose to be quiet rather than depress the quotation and they may receive the scuttling of the chief promoters of the company with passive surprise, but we feel sure that the episode will tend, most properly, to undermine the confidence of the speculative public in Rhodesian mining.

### Value of Management.

Those who read reports and prospectuses, casually, will be impressed with the idea that the profit gained from exploiting mines is largely increased by good management, systematic operations, and large-scale equipment. This impression is not altogether without some basis of fact, but it needs to be taken with caution. Among mining engineers it should be accepted with humility. We remember the story of a poor shareholder who had a holding in several companies that seemed to be the victims of recurrent reconstruction. Every time that this happened the chairman would say something to the effect that the mine was a good one and all it needed was good management. Finally our friend the shareholder arose at a meeting and exclaimed that the next time he bought any shares it would be in "a mine that could stand bad management." He was not far wrong. The difference between the good and the bad management might be 20%, and 20% is a healthy margin. Be not deceived; an engineer who takes as his only margin of profit the economies due to the difference between his skill and that of his predecessor is skating over thin ice and usually ends in getting a ducking. Even the youngest of us is not infallible; it is well to base estimates on a securer foundation. It is unwise to assume that big companies can operate more cheaply than small syndicates, or even that a syndicate of all the talents can work as economically as the local man who made the mine. The Camp Bird is a case in point. It was owned by the late Thomas F. Walsh, a shrewd and experienced mine operator. From October 1896 to June 1900 his total cost averaged $6·50 per ton. A mining engineer of some experience, not unfamiliar with local conditions, estimated that an English company operating on a bigger scale and with a more complete equipment, could reduce the total cost to $5·25 per ton. This mine justified his report in every way, in tonnage, in yield of gold, and in dividends, but the company's average cost for 10 years thereafter was $10 per ton; and this despite consulting and advising engineers of the first rank and an equipment as complete as money could buy. In this particular case it may be mentioned that the owner, who was an excellent general manager, charged no salary to the mine, although he devoted his personal attention to it His superintendent, a faithful and efficient overseer, was paid less than the company's superintendent, but he was as good a man. Under private ownership there was no expense for directors, consulting engineers, London offices, and so forth. Moreover, the necessity for having a big reserve of ore, a large part of it actually broken and left in the stopes, in order to make the shareholders comfortable, all entailed an extra expense for development and the use of capital in an unproductive manner. The company's management was not extravagant, but it had small reason to observe the minor economies that are natural to an individual owner; in short, we doubt whether the mine was better operated after the transfer, and, as we have seen, it was

operated much more expensively. This instance is worth citing because both the original owner and the company that was his successor were above the average in skill and resources. Some of the cleverest mining engineers gave advice to the company; some of the most competent specialists aided it in geological and metallurgical difficulties. In brief, a company cannot work as cheaply as an individual; the responsibility is divided, the authority is distributed, the profit is worried before it is glorified into a dividend. An increase in the scale of operations is not advantageous if it transcends the economic unit.

### East Rand Proprietary.

The special meeting called by Sir George Farrar was held on January 18. The Great Hall of the Cannon Street hotel was crowded with brokers, dealers, and shareholders. The chairman made a good start, his willingness to face the inevitable unpleasantness winning him the sympathetic applause of friends, of whom many were present. When he came to review the famous 'irregularities,' he read his explanation. It was long, it threw no fresh light on the maze of shifty doings, and it furnished no valid excuse for the series of events that culminated in a fiasco so fateful to the reputation of Rand mining. Sir George spoke for 65 minutes. The speech was interrupted by occasional dissent and it evoked intermittent protest, as when he undertook to explain the drop, amounting to 38½%, in East Rand shares by pointing to the 37% fall in the quotations of four other important companies. As if the demoralization of the market were not mainly due to the East Rand disclosures! This was feeble, and raised doubts as to the speaker's sincerity. In acknowledging that the postponement of the monthly clean-up had been kept secret, he exclaimed to the audience: "Under like conditions I think nine out of ten would have acted as I did." This was met by many vigorous cries of 'No.' Unless that 'No' can be given with continued assurance we shall have good reason to fear further maladministration on the Rand. It was a weak retort. The speech ended with references to the speaker's political activity, and usefulness. But this prolonged a statement already too lengthy. It was an ineffective herring across the trail of misdoing. Then arose the representative of the dominant factor in this imbroglio. Mr. R. W. Schumacher, speaking for the Central Mining (lately Wernher-Beit) group, left no doubt as to the real position. He spoke quietly and pleasantly, but with an assurance of power behind him. The chairman had stated that the new board would include one representative of Barnato Bros., two representatives of Central Mining, as well as the advisory engineer, also their nominee, one representative of S. Neumann & Co., three of the French group, besides Mr. Julius Friedlander, representing himself, and Sir George Farrar. Thereupon Mr. Schumacher explained that his house desired "to restore the prestige of the Witwatersrand," to let the dead past bury its dead, and to inaugurate "a policy of effective reform." He calmly informed the shareholders that he and his friends had reviewed all the circumstances and they had decided not to be too hard on Sir George; he would be permitted to retain the chairmanship on the understanding that he surrendered all his power, which passed to the Central Mining, by the presence not only of three directors on the board, but by the nomination of both the advisory engineer and the manager. Mr. Ross Skinner, as advisory engineer, is to be a director, and he is to be "the sole medium between the board of directors and the officials in the mine, and all orders from the board are to be conveyed through nobody but him." The chairman will preside, that is all. Mr. Schumacher's speech was impressive as a who's who, but it was a trifle top-lofty. Those present were invited to disregard Sir George and the array of

gentlemen sitting at the council table—mere simulacra—and to focus their eyes on the real thing, the representative of the Central Mining, to whom, in the course of human events, an intelligent providence had deputed the entire control of affairs. After other shareholders had asked questions of a searching kind, it was left to Mr. Francis J. Dormer to express some of the necessities of the case in a number of resolutions. Mr. Dormer spoke clearly and convincingly, his known character and experience assured him an attentive hearing, and he made the most of it by contributing a speech that was really helpful. The resolutions covered the abolition of the gold reserve, a reduction in the number of directors, an annual meeting of shareholders in London, and the extinction of the London committee. The speaker insisted most properly that the trouble and expense of circularizing the shareholders should be borne by the company itself, which has the machinery requisite for a referendum. We may anticipate by saying that all of these resolutions, save the one referring to annual meetings, were carried. Mr. Dormer's motion was seconded by Mr. Aubrey Hyman, who spoke with a familiar accent, but started with the general support of the meeting, even though he made a series of damaging assertions against the chairman. When, however, he undertook to depreciate the East Rand property, he touched the pocket-nerve of the shareholders. Interruptions ensued. He was called a 'bear.' He retorted by saying that the bears had saved the public lots of money; a bear was one who "by intelligent anticipation of events" lets the public know the real facts; he does not listen to the chairman or directors, and so forth. This was amusing, but it was beside the mark. The gentleman from Johannesburg had aroused the suspicion that he was playing a sinister part; he lost his hold on the audience; after many interruptions, and an unseemly wrangle with the chairman, he subsided. Then Mr. Edmund Davis asked "to be excused for one minute" while he referred to the incidence of the income tax on mining companies, with further suggestions and criticisms of the East Rand Proprietary system of announcing profits. Mr. Davis received some interruptions from Mr. Percy Farrar, but it is a wonder that he got a hearing at all. A criticism of the chairman of the East Rand emanating from the chairman of the Prestea is enough to provoke sardonic humour even in a Sunday School teacher. Mr. Davis was accorded a surprisingly courteous hearing and was followed by a shareholder who animadverted on the submission of the minutes of board meetings to directors not present, so that leakage of important information became inevitable, one group telling another, and one operator exchanging with his brother in the market. After this Sir George Farrar rose to reply. By this time the temper of the meeting was less complacent. He was heckled over the debenture issue, and made a lame retort, promising one objector that he would get a better chance "next time." Interruptions were frequent. He was asked if he would support the proposals embodied in Mr. Dormer's resolutions. He agreed with apparent unwillingness to "advocate" them. Messrs. Hyman and Davis interjected remarks. The chairman was obviously losing control of the meeting. The proceedings became unparliamentary. The resolutions were put to the vote; all were declared 'carried' except the most important, in regard to annual meetings. The sense of the meeting was in its favour, but Mr. Davis made counter-suggestions, the chairman was confused, somebody suggested that meetings should be held at Paris and Berlin also, it was not clear whether 'the' annual meeting or 'an' annual meeting should be held in London. The show of hands proved adverse. Not many voted, and probably only a minority of those present were shareholders. By this time the meeting was out of hand and

had become disorderly. When the last resolution was passed, abolishing the London committee, there was a quick exodus to the luncheon rooms. Amid the noise of dispersion, a vote of thanks to the chairman was proposed and carried; but it was a perfunctory compliment. Sir George Farrar had gained nothing by meeting the shareholders. The East Rand remained an unexplained fiasco, the large hand of the Central Mining had been shown, and sundry peculiar people had been permitted to pose as exemplars of financial rectitude.

## Copper.

The outlook for copper, so gloomy a year ago, brightened rapidly during the closing months of 1911, so that the new year brings comfort to those engaged in winning that metal. From £53 per ton of standard copper in May, the price rose to £63 in December. At New York a price of 14 cents per pound has replaced the cheerless 12 cents that prevailed during the early part of last summer. This time the rise is not due to artificial conditions, but to a genuine growth of consumption. During October and November the leading American producers sold a large accumulation of metal, and it was reported that several of the bigger selling agencies had depleted their stock in hand. In November the American output was the lowest for two years; it was 14% below that of March, which was the highest in 1911. Of course, the statistics of the American Copper Producers' Association must be read with discrimination, for they do not reflect conditions with all the faithfulness that the casual reader may credit to them. In the first place these statistics include all the foreign copper refined in the United States, as well as imported matte, from Canada, Mexico, Cuba, and South America. Less comes from Australia than heretofore, yet the total foreign copper refined in the United States and included in the figures of the American Copper Producers' Association is fully 20%; for instance, in 1911 it was 146,705 tons. Only refined copper, not that in transit or in vats awaiting refinement, is included in the 'stocks.' The production given is that of the refineries, and not of the mines. Deliveries include all the copper that has left the refineries, that classified as 'exported' has been consigned for foreign ports, but it may not have been shipped. Hence the discrepancies between the Government figures and those of the Association. However, while differing in detail, both unite in exhibiting the relative growth of consumption and the abatement of expansion in production which threatened the market a year ago. During 1911 the United States output increased 7620 tons, to 492,549 tons; this increase is significant because it is so small. In the same period the total American production, which includes foreign ores treated in the United States, diminished, from 648,286 to 639,258. The decrease is due probably to the smaller imports of blister copper from Australia, this product being now largely refined at Port Kembla. In November the domestic American consumption was 30,375 tons, the highest recorded since January 1910. For the 12 months the average monthly consumption was 26,380 tons, as against an average of 27,900 during 1910. In regard to American exports the average monthly total was 28,064 tons in 1911, as against 26,900 tons in 1910. The final result of these changes has been a decrease of 14,543 tons in American stocks. In Europe the total supplies, according to Henry R. Merton & Co., have declined to 70,683 tons, making a satisfactory diminution of 34,914 tons. At the end of 1911 the total visible supply consisted of 42,104 tons in England and 5254 in France, 9925 tons afloat from Chile and Australia, 13,400 tons at Hamburg and Rotterdam, and 39,935 tons in America, a grand total of 110,618 tons of copper, as against 160,075 tons a year ago.

The decrease of 49,457 tons was quite enough to enliven the market. In June 1910 the total supply was 180,000 tons.

Ever since the American panic in November 1906 when the price of copper was halved, the quotation has been depressed. That continued depression in price has led to a wider use of the metal, thereby tending to restore its market value. Thus the total stock of metal available has declined by 70,000 tons during a year and a half, while the world's supply of merchantable copper is now equal only to about six weeks' consumption. In 1900 the total production of the world was 486,000 tons and the total consumption was 500,000 tons. By 1910 the production had risen to 837,500 tons, but the consumption meanwhile increased to 900,000 tons, indicating that consumption expanded 4% faster than production. In 1911 this tendency was accentuated, so that the stock of metal available is less than it was just before the big drop, a little more than five years ago.

The general consumption of copper has increased in most countries, the one important exception being the United States, as the following statistics, supplied by James Lewis & Son, will indicate:

| | 1909 | 1910 | 1911 |
|---|---|---|---|
| England | 68,900 | 96,436 | 97,292 |
| France | 58,089 | 65,486 | 80,837 |
| Germany | 116,953 | 117,169 | 135,487 |
| United States | 318,050 | 339,372 | 325,431 |
| Italy, Austria, and Russia | 28,804 | 32,432 | 35,565 |

These statistics are not complete. In 1911 other countries consumed about 225,000 tons more. European consumption, especially in Germany, has more than redressed the poorer demand in America, and if the industrial depression recently prevalent in the United States is followed by one of the recurrent periods of expansion, as is likely, it may be expected that the demand for the metal will become stimulated to a notable degree. Already the recovery in the steel business has brought a fresh demand for railway supplies, thus creating the need for more copper; in Europe the electrical and engineering industries are extending their requirements; in England the shipbuilding tonnage under construction presages a largely increased demand for copper. It remains to consider the probabilities of production. It is estimated that the 'disseminated copper' group of mines, the decisive factor in recent years, is now yielding about 19,000,000 lb. or 8500 tons of copper monthly; and it is believed that when all the members of this group, in Nevada, Utah, and Arizona, get into their stride, they will produce 34,000,000 lb. or 15,000 tons monthly. During 1912 the Miami and Chino mines should attain to full production. The Ray will do so shortly afterward. In 1914 and 1915 the Inspiration, Live Oak, and Keystone mines will become productive. Thus the maximum output of this group will be attained in four years. This means about 182,000 tons of copper per annum. It is a large contribution, but it lacks the nebulous and terrifying dimensions of that foreshadowed when first this type of copper deposit became a prominent factor. It is likely that the world's production will augment by 67,000 tons in 1912, but it must be remembered that the world's consumption increased 73,000 tons in 1909 and 150,000 tons in 1910. Hence, if trade expands, the maximum contribution of 182,000 tons from the 'disseminated' copper group in 1915 may be assimilated without straining the market unduly.

The older mines controlled by the Amalgamated and Phelps Dodge groups are not being pressed, the managers restricting output to those mines that are able to produce cheaply. In the Lake Superior region the Calumet & Hecla and the Ahmeek each show an increase of 3,000,000 lb. or 1340 tons for the year, but the total output remains much the same. Several of the best mines are approaching exhaustion. No expansion of copper production

in Michigan is likely, on the evidence now available. The total production of United States refineries for 1911 is reported at 639,354 tons, as against 648,268 tons in 1910. Of this total 25% is produced at a cost of 10 cents or more per pound, that is, 75% is produced for less than 10 cents per pound. The Rio Tinto is being operated with wise restraint. The South American and African mines that threatened not long ago to upset the balance of supply and demand remain impotent bogies. Given a normal growth of manufacturing and railroad activity in America and a continuance of industrial expansion in Europe, the present copper output should be comfortably assimilated. The average growth in consumption is 7%. The low price ruling during recent years has extended the use of the metal to new purposes. Two years ago we believed that the attempt to restrict output would fail, and that a succeeding period of lavish over-production would depress the price so as to compel all but the cheaply producing mines to close-down; in other words, that a forced liquidation was impending. It now appears that so desperate a remedy may not be necessary, that the threatened glut of copper has been escaped, and that the present growth of copper mining will be met by a compensating demand for the metal.

## Rand Reform.

All the groups have now agreed to issue reports and balance-sheets to European shareholders well in advance of the annual meetings, whether held at Johannesburg or London. This indicates a desire to conciliate public opinion, but it does not afford any real measure of protection to shareholders. At the East Rand meeting Sir George Farrar said that an annual meeting might be called in London on "every eventful occasion." We may assume that shareholders do not desire "eventful occasions," like the one that necessitated the East Rand special meeting, and that they would like to prevent any cause for unpleasant disclosures in the future. It is too much like holding a committee meeting of the coachman, groom, and hostler, after the horse has vanished from the stable. What is required is effective recognition of the numerous and scattered small shareholders who, in the aggregate, supply so large an amount of capital for mining purposes in the Transvaal. One independent director, chosen for his knowledge of mining affairs, should sit on the board of each company, not to represent a financial group nor his own holding, but the very persons who are now denied any voice in the management of the property. If the existing directors were indeed what they ideally should be, namely, trustees for the shareholders, not for some of them but all of them, then we should not need to raise the question now much debated. Unfortunately the controllers are apt to be promoters and share-dealers; they are entitled to the control in many cases, because they found the property and financed it, supplying much of the capital themselves, but so long as they appeal for public support they must recognize the corresponding obligation, which is to give every shareholder a run for his money and adequate protection. Unless the general meetings are held in London and unless the directors are resident here, no safeguard will avail. The talk about taxes is largely misleading; income tax is paid by the recipient of dividends; even German and French shareholders can afford to pay the tax if it is accompanied by added security. No tax is so great as that paid to uncontrolled incompetence. A board sitting in an office 7000 miles away is immune from effective criticism and becomes callous to public opinion in Europe. If the groups can get on without public support, they will do as they like; if they depend upon the public to find the money for their enterprises, they will do well to show proper regard for the rights of the small shareholder.

# METAL MARKETS

## COPPER.

Average prices of cash standard copper:

| Jan. 1912 | Dec. 1911 | Jan. 1911 |
|---|---|---|
| £62. 17s. 6d. | £61. 5s. 11d. | £55. 14s. 3d. |

The market during January has been overshadowed by the depressing influence of the Stock Exchange and especially of Wall Street. Europe continues to absorb the metal with undiminished appetite, even increasing her consumption. During 1911 shipments from America amounted to 337,007 tons, as against 322,513 for 1910 and 302,642 for 1909. Yet so much are prices divorced from these prosperous indications that since the end of the year they have suffered a severe decline, three months falling from £65 to £62. 10s., following the drop in American securities. Consumption in America, as the published statistics indicate, is not all that has been expected of it; yet the figures show a distinct improvement for the last quarter of 1911, and there seems no justification for pessimistic feeling. Though it is true that the advance from £55 to £65 is considerable, it should be borne in mind that at the lower figures, prices were unduly and unjustifiably depressed, as the rapid recovery proved. The bull account which arose in December has been largely liquidated and a bear account opened. The latter is believed to be of pretty considerable dimensions, so that the technical position is favourable to a substantial recovery as soon as political exigencies in America give the signal for another forward move. In the meantime European trade is flourishing on the inestimable benefit of cheap American supplies. The American Copper Producers' figures for January show that consumption is still ahead of production and that the stocks have further decreased by 10,000 tons to 29,589 tons.

## TIN.

Average prices of cash tin:

| Jan. 1912 | Dec. 1911 | Jan. 1911 |
|---|---|---|
| £191. 14s. 0d. | £203. 7s. 2d. | £187. 17s. 11d. |

This market has been under the influence of more settled conditions and is becoming used to the terms of the new tin contract. There is no doubt that these terms make for the protection of buyers and will broaden the basis of business. Commencing at £205 for cash, the market declined while the Syndicate liquidated its holdings, until £184 was reached. On the 15th fresh purchasing of forward tin recommenced and prices rose rapidly once more to £195. 10s. for cash and £193 for three months at the end of the month. The heavy backwardation, so long characteristic of this market, has disappeared and now rules about £2 per ton. America bought largely at about £194, and a good deal of bear covering and general buying developed when the result of the Banca sale became known. On this occasion 2614 tons was sold at an average of £194. 15s. The East has disposed of good lines at the higher figures. The month closes with a somewhat smaller turnover and prices fluctuating within narrow limits. The statistics are considered favourable, as they include a large quantity of Banca released by the auction.

## SPELTER.

Average prices of spelter:

| Jan. 1912 | Dec. 1911 | Jan. 1911 |
|---|---|---|
| £26. 9s. 11d. | £26. 13s. 7d. | £23. 16s. 9d. |

Galvanizers are very busy and are optimistic as to future prospects. They, however, have remained out of the market for most of the month, and the London quotation was in consequence reduced to £25. 17s. 6d. The syndicate price, however, is unaltered. Consumers will no doubt be compelled to buy shortly, but at present are nursing their resentment at the syndicate's terms.

## LEAD.

Average prices of soft foreign lead:

| Jan. 1912 | Dec. 1911 | Jan. 1911 |
|---|---|---|
| £15. 11s. 3d. | £15. 15s. 4d. | £15. 0s. 8d. |

Prices have been subject to little variation. Trade has not been brisk, but buyers have shown some urgency in claiming deliveries that were delayed through the scarcity of shipping opportunities. In consequence spot metal was being sold at good premiums. There is, however, no general buying movement, and the convention dealers have used every rise to make sales.

## OTHER METALS AND MINERALS.

Prices quoted on February 10:

SILVER.—27⅛d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£56 per ton.

NICKEL.—£170 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£28 per ton.

QUICKSILVER.—£8. 5s. per flask.

MANGANESE ORE.—8d. to 9½d. per unit (1%).

IRON ORE.—Cumberland hematite 23s. 6d. per ton at mine. Spanish 21s. 6d. delivered.

PIG IRON.—Cleveland 49s. 6d. per ton. Hematite 64s. per ton.

WOLFRAM ORE—30s. per unit (1%).

# SPECIAL CORRESPONDENCE

## News from our own Correspondents at the principal mining centres

### HONGKONG.

The mineral output of Southern China has been curtailed by the revolution. At Hongkong tin is accumulating in the shape of bars that were brought from the province of Yunnan before the outbreak some two months ago. The tin mines are still working, but propecting has ceased. The revolution, however, should have no great effect on the output of tin, as the metal is brought by train over the French railroad in Tongking and then by ocean-steamers from Haiphong to Hongkong. The curtailment has been principally in antimony, gold, and coal. These ores are brought down from the mines by small river-boats to various towns. At Wuchow, the centre for antimony, regulus is being made and shipped. The uncertainty of government, however, will soon be felt, as the old Government received 50% of all the antimony, and it is still a moot question whether the new Government will claim the same percentage or treat the operators liberally. The members of the new Government seem to favour mining laws for Canton province similar to those of Arizona in America. If this is done, much good will result. The gold output is not over 40 ounces per week, as most of the men who have been panning the various creeks have gone to the large towns to await the outcome of the revolution. Mr. Conran, an American prospector, had his house-boat raided by river pirates. Mr. Ober, who was installing a milling plant and carrying on placer operations, reports no trouble in his locality. Coal-mining operations by Mr. Yung, a certificated Chinese mining engineer, have been stopped. Some $200,000 was spent under the direction of Mr. Yung and much was expected in Canton and Hongkong from him. The revolution is not to be blamed for this shut-down, as it was due to lack of funds more than to the fear of trouble or bloodshed. Many mining men at Hongkong look for the new Government to pass favourable laws and to give protection, and there is no question that if this is done they will spend money in prospecting.

In the Philippine islands, the results for last year were not much better than in Southern China. The new mill of the Headwaters Mining Co., representing an outlay of $100,000, was forced into idleness because a typhoon destroyed the road to Baguio. Trouble was also experienced with the cyanide process, which includes agitation in Pachuca vats and filtering with Ridgway machines. The road is expected to be re-constructed soon and the milling process is to be changed. Other mines at Baguio suffered from floods, the plant of the Benguet Consolidated company being entirely carried away.

### KALGOORLIE.

**Drought.**—The heat continues, likewise the shortage of water in outside districts. The Miners' Water Supply Department is working hard in drilling for water, sinking wells, and preparing dams. They have in hand a good scheme for a supply for Ora Banda, where the Associated Northern will have a mill running about May. The temperature stays at from 90° to 102°, with many thunderstorms and dust; but no rain. The drought has lasted nearly two years. The Annual Report of the Water Supply is an interesting document. It is the life of our great centre here, likewise small mining centres along the pipe-line, and several farming districts. The total consumption amounted to 1,058,900,000 gal., with a revenue of £237,000; but working expenses, interest, and sinking fund on the capital caused a deficit on the year's operations of £25,000. The lime treatment of the water is having a beneficial effect on the interior of the pipe in preventing excessive corrosion.

**Labour.**—The Engineers' Society, which went out for two weeks to discuss overtime rates, etc., with the Chamber of Mines, agreed to go to arbitration. The award has angered the men, for their position is worse than before, as they must work four hours over-time before getting extra rates, which are only time and a quarter; while the Court could not be bothered to discuss classification of men and night-work. It was an ill-timed and stupid attitude for the Society to assume. Several years ago it might have paid them, but not now.

**Deep Mining.**—It is satisfactory to note that the Boulder is allowing the Horse-Shoe to cross-cut and drill from the former's 2650 and 2800 ft. levels. The Horse-Shoe requires a push in development; but the secre-

tary's inspired notices will not help matters. The enlarged mill was to deal with 33,000 tons monthly; but there is never enough ore to maintain this output. Locally the Ivanhoe is considered the soundest proposition. MacAulay is making strenuous efforts at the Associated, but beyond squaring up things somewhat, the results are poor.

**Railway and Prospecting.**—A good number of people are still leaving Kalgoorlie for other parts. Now that the Federal Government has passed the Trans-Australian Railway Bill, raised the first million for its construction, is organizing its staff, and received the sanction of the South and West Australian governments to construct the line, we expect an influx of men, and consequently more local business. Prospectors will follow the line construction, and it is quite likely something may be found. The Norseman-Esperance railway scheme has been defeated in our Legislative Council. It passed by 25 to 16 in the Assembly, but the representatives of vested interests in Perth and Fremantle are too strong. This line would certainly open up good farming country within 200 miles of Kalgoorlie, save three days of steamer and rail freight on all fuel, food, and supplies generally, a fine pleasure resort for the mining people and generally a help toward reducing the cost of living. The curse of centralization lies heavy on Western Australia and on some of our Eastern States. Curiously, the Chamber of Mines has never helped our Esperance railway project one little bit. The Chamber is ruled by one man and his secretary, and until they are displaced we may expect a good deal of stagnant business.

**New Mines.**—The present year should test the real value of the new mines about to start crushing or erecting mills, such as the Yuanmi, Mountain Queen, Transvaal, Marvel Lock, Bullfinch, and Gimlet South Extended. The plant of the last named should be of much interest, as it is to consist of a breaker, Huntington mills, classifiers, pans for regrinding, thickeners, agitators, and vacuum filtration, all driven by Tangye gas engines. Roberts expects to mine and treat for 12s. 6d. per ton, and probably 15s. will cover all costs. This on 9000 to 10,000 tons monthly would be good work. There are a lot of low-grade prospects at the north end of Kalgoorlie that crush oxidized ore in Huntington mills, and then cyanide the sand and slime, the returns varying from 5s. 6d. to 18s. per ton, and profitable at that. Larcombe's geological report has come in for criticism here by laymen, who argue that he suggests nothing of real value for the 'Golden Mile.'

## WASHINGTON.

**Mineral Statistics.**—This is the season of the year when figures of production and consumption are much in evidence. There is no real reason why summaries should be made at the end of December rather than end of November. As a matter of fact the figures published January first each year are based upon production for the first eleven months, and estimates for the twelfth, but as such estimates vary but little from final figures they are generally accepted and used. Habit is strong, and I shall yield to the current and 'lisp in numbers for the numbers come.' At Washington there are a number of bureaus that collect statistics of importance to mining men. The Statistical Bureau of the Treasury publishes figures of exports and imports, the Census Bureau distributes bulletins that are extremely serviceable in historical collections, the Director of the Mint makes each New Year a careful estimate of the gold and silver production of the United States, and the United States Geological Survey spends the succeeding 12 months determining where all the metal came from. This year the estimates from the Mint for 1911, and the final report of the Survey on the gold-silver production in 1910, were received at practically the same time. Of recent years the Geological Survey has, however, been itself furnishing preliminary estimates of metal production and they have proved to be quite exact. It is easy for the great statistical offices of the Government to determine the totals within a few days after the close of the year, but to analyse the figures, check them, and determine the true sources of the metals is another matter and takes months of work. Some of these things are illustrated in the figures quoted below.

**Gold and Silver.**—Preliminary estimates of production in 1911 are given below through the courtesy of George E. Roberts, Director of the Mint. For comparison the final figures for 1910, as compiled by the statisticians of the United States Geological Survey, are also given.

It will be noted that there was a slight decrease in gold production and a minor increase in the case of silver. Studying the figures more in detail, it is interesting to note that in gold production California leads, with Colorado and Nevada close seconds. The three, with Alaska, rank well ahead of any of

the other States. The preliminary estimates include a considerable amount of both gold and silver not traced back to its original source and some evidently wrongly reported. For example Oklahoma has no silver mines, though silver-bearing zinc ores from Colorado and other Rocky Mountain States are treated at Oklahoma smelters. So, too, Illinois has no gold mines, though gold may readily reach the Mint from that State. Silver, however, is present in the lead ores of Southern Illinois, and is regularly produced. These minor discrepancies indicate that even the best preliminary estimates are to be used with discrimination.

Alaska, Tennessee, Colorado, Idaho, and New Mexico. According to the figures of the Copper Producers' Association published January 8, December production from the refineries amounted to 122,896,697 lb., which makes the total output for the year 1,431,938,338. The difference between this and the figures of the Geological Survey arises from the fact that the one takes account of refinery and the other of blister copper. The surplus at the end of the year stood at 89,454,695 lb. as compared with 122,030,195 on January 1, 1911. The difference is due largely to European buying and has been the signal for raising prices, though there is some scepticism as to

GOLD AND SILVER PRODUCTION IN THE UNITED STATES.

| | Gold | | | | Silver | | | |
|---|---|---|---|---|---|---|---|---|
| | 1910 | | 1911 | | 1910 | | 1911 | |
| | Fine Oz. | Value | Fine Oz. | Value | Oz. | Com'l Value* | Oz. | Com'l Value |
| Alabama | 1,592 | $ 32,900 | 887 | $ 18,335 | 300 | $ 200 | 174 | $ 96 |
| Alaska | 787,148 | 16,271,800 | 774,144 | 16,002,976 | 153,900 | 83,100 | 275,691 | 151,630 |
| Arizona | 165,114 | 3,413,200 | 142,938 | 2,954,790 | 2,655,700 | 1,434,100 | 1,594,428 | 876,935 |
| California | 988,853 | 20,441,400 | 982,544 | 20,310,987 | 1,791,600 | 967,500 | 2,727,336 | 1,500,035 |
| Colorado | 982,969 | 20,526,500 | 926,568 | 19,153,860 | 8,523,000 | 4,602,400 | 7,530,940 | 4,142,017 |
| Georgia | 1,161 | 24,000 | 1,477 | 30,532 | 300 | 200 | 225 | 124 |
| Idaho | 50,112 | 1,035,900 | 56,563 | 1,169,261 | 7,027,000 | 3,794,600 | 7,507,802 | 4,129,291 |
| Illinois | — | — | 280 | 5,788 | 2,000 | 1,100 | 4,648 | 2,556 |
| Kentucky | — | — | — | — | 100 | 100 | — | — |
| Michigan | — | — | 1 | 20 | 262,200 | 141,600 | 507,234 | 278,979 |
| Missouri | — | — | — | — | 32,200 | 17,400 | 56,228 | 30,925 |
| Maryland | — | — | 1 | 20 | — | — | 87 | 48 |
| Montana | 179,975 | 3,720,400 | 153,341 | 3,169,840 | 12,282,900 | 6,632,700 | 11,116,778 | 6,114,228 |
| Nevada | 913,015 | 18,873,700 | 917,605 | 18,968,578 | 12,366,000 | 6,677,600 | 10,651,571 | 5,858,364 |
| New Hampshire and Pennsylvania | 285 | 5,900 | — | — | 700 | 400 | — | — |
| New Mexico | 23,085 | 477,200 | 30,955 | 639,897 | 779,000 | 420,600 | 1,142,335 | 628,284 |
| North Carolina | 3,120 | 64,500 | 3,710 | 76,693 | 8,300 | 4,500 | 2,227 | 1,225 |
| Oklahoma | — | — | 1,485 | 30,698 | — | — | 168,245 | 92,535 |
| Oregon | 32,963 | 681,400 | 28,988 | 599,235 | 43,800 | 23,600 | 69,116 | 38,014 |
| Pennsylvania | — | — | 378 | 7,814 | — | — | 13,262 | 7,294 |
| Philippines | 7,469 | 154,400 | 6,313 | 130,501 | 1,800 | 1,000 | 3,383 | 1,861 |
| Porto Rico | 48 | 1,000 | 106 | 2,191 | — | — | 51 | 28 |
| South Carolina | 1,829 | 37,800 | 650 | 13,437 | — | — | 14 | 8 |
| South Dakota | 260,267 | 5,380,200 | 359,444 | 7,430,367 | 120,600 | 65,100 | 206,188 | 113,403 |
| Tennessee | 135 | 2,800 | 684 | 14,140 | 69,800 | 37,700 | 126,683 | 69,676 |
| Texas | 19 | 400 | 57 | 1,178 | 364,400 | 196,800 | 442,486 | 243,367 |
| Utah | 208,627 | 4,312,700 | 227,834 | 4,709,747 | 10,445,900 | 5,640,800 | 12,679,633 | 6,973,798 |
| Virginia | 44 | 900 | 208 | 4,300 | 200 | 100 | 45 | 25 |
| Washington | 38,990 | 806,000 | 24,407 | 504,537 | 204,900 | 110,600 | 142,196 | 78,209 |
| Wyoming | 198 | 4,100 | 909 | 18,791 | 1,300 | 700 | 1,009 | 555 |
| Miscellaneous | — | — | 12,820 | 265,013 | — | — | 826,102 | 454,356 |
| Total | 4,657,018 | $96,269,100 | 4,655,297 | $96,233,528 | 57,137,900 | $30,854,500 | 57,796,117 | $31,787,866 |

* Value 54 c. per ounce.

**Copper.**—The statistics of copper production and consumption now published monthly by the Copper Producers' Association are so complete as to leave little to be desired. A general summary made by B. S. Butler of the Geological Survey and based upon returns made direct to that bureau, indicates that the output from the United States in 1911 exceeded that of 1910 and nearly equalled the record production of 1909. According to the statistics and estimates received, the output of blister and Lake copper was 1,091,554,000 lb., against 1,080,159,509 lb. in 1910, and 1,092,951,624 lb. in 1909. Arizona again holds first place, followed in order by Montana, Michigan, Utah, Nevada, California, whether all foreign orders are for consumption.

**Lead and Zinc.** — Geological Survey figures indicate a prosperous year for lead and zinc producers. The output has increased and prices, particularly of spelter, have been favourable. For the first time, too, in recent years zinc smelter-men have worked on a good margin. According to the estimates of C. E. Siebenthal of the Survey, among lead producers the Southeastern Missouri district fell behind about 4%, while Idaho gained 15%. Utah gained 8%, Nevada output decreased 9%, and Colorado remained stationary. Among zinc producers it is known that the Joplin output was slightly less than in 1910, while that

of Wisconsin and of Montana and other Rocky Mountain States increased markedly. Mr. Siebenthal summarizes the year's figures as follows: The production of spelter from domestic ore is estimated at 273,807 short tons, and from foreign ore at 14,237 tons, a total of 288,044 tons, worth, at the average price, $33,837,000, as compared to a total of 269,184 tons in 1910, made up of 252,479 tons of domestic origin and 16,705 tons of foreign origin. The production of spelter from both domestic and foreign ores, apportioned according to the States in which smelted, was approximately as follows: Illinois, 84,626 tons in 1911, as compared to 73,038 tons in 1910; Kansas, 97,790 tons in 1911, as compared to 105,697 tons in 1910; Oklahoma, 46,061 tons in 1911, as compared to 34,760 tons in 1910; all other States, 59,587 tons in 1911, as compared to 55,689 tons in 1910. The total production of spelter is equivalent to the output of 67,555 average retorts operating continuously through the year, or about 80% of the effective smelting capacity of the country when working 60% zinc concentrate. The apparent domestic consumption of spelter in 1911 may be computed as follows: The stock on hand at smelters at the beginning of the year, 23,232 tons, plus the imports, 285 tons, and the production, 288,044 tons, gives the total available supply of 311,561 tons. From this there are to be subtracted the exports of domestic spelter, 5292 tons, the exports of foreign spelter, 10,678 tons, the exports under draw-back, 2628 tons, and the stock on hand at smelters December 15, 9025 tons, a total of 27,623 tons, leaving a balance of 283,938 tons as the apparent domestic consumption. This calculation takes no account of the stocks of spelter held by dealers or consumers. On comparing the consumption in 1911 with the 245,884 tons consumed in 1910, the 270,730 tons in 1909, the 214,167 tons in 1908, and the 226,969 tons in 1907, it is to be noted that the apparent consumption is abnormally large, indicating that stocks other than those at smelters have appreciated.

The total production of refined lead, desilverized and soft, from domestic and foreign ores in 1911 was approximately 487,520 short tons, worth at the average New York price $43,876,800, compared to a production of 470,380 tons in 1910 and 448,112 tons in 1909. These figures do not include an estimated output of 13,195 tons of antimonial lead, against 14,069 tons in 1910 and 12,896 tons in 1909. Of the total production, desilverized lead of domestic origin, exclusive of desilverized soft lead, is estimated at 208,428 tons, against 193,213 tons in 1910; and desilverized lead of foreign origin at 89,706 tons, compared to 108,553 tons in 1910. The production of soft lead from Mississippi Valley ores is estimated at 189,386 tons, compared to 169,244 tons in 1910, which means that Missouri retains first place among the lead-producing States. The final figures for the production of soft lead in 1911 are likely to show an increase of a thousand tons or so over those above given because the argentiferous-lead smelters and refineries undoubtedly treated more or less soft-lead ore from the Mississippi Valley which is not taken into account in their preliminary estimates. The amount of lead available for consumption during 1911 may be estimated by adding the stock of foreign lead in bonded warehouses at the beginning of the year, 35,972 short tons, the imports, 91,244 tons, and the domestic production, 397,814 tons, making an apparent supply of 525,030 tons. From this is to be subtracted the foreign lead exported from warehouse, 103,656 tons, the exports of foreign lead in manufactures under draw-back, estimated at 10,468 tons, the deduction by liquidation, 16,178 tons, and the stock in bonded warehouses at the close of the year (assumed to be the same as at the close of November), 3728 tons, leaving as available for consumption 391,000 tons, which by comparison with 376,021 tons in 1910 and 370,013 tons in 1909 seems to be a normal increase.

**Coal and Iron.**—The year 1911 was distinctly unfavourable as regards coal production, according to E. W. Parker. He estimates the anthracite output at 80,100,000, about 4,700,000 tons above that for 1910. This gain, however, is more than offset by the loss in bituminous, which was mined to the extent of 3 to 5% less than in 1910. On this basis the total coal production may be estimated at between 485,000,000 and 496,000,000 tons, as against 501,600,000. This decrease reflects accurately the slowing down of business which marked the year, in the United States, since coal is not to any extent carried in stock from one year to another. Iron ore shipments from the Lake Superior region amounted to 32,130,411 long tons as compared with 42,620,201 tons in 1910. The total sales of iron ore are estimated by E. F. Burchard at 43,000,000 to 46,000,000 tons, representing a decrease of 22 to 24% from the sales of 1910. According to figures collected by *The Iron Trade Review*, which by the way is hereafter to appear in daily edi-

tion, pig iron production amounted to but 23,198,910 tons compared with 26,845,904 in 1910. A more cheerful statement is to the effect that iron and steel exports for the year amounted to $250,000,000, a record figure, and 18% in excess of the shipments in 1910. Lower prices in the latter part of the year stimulated business and the U.S. Steel Corporation at the beginning of the year had unfilled orders calling for 450,000 to 500,000 tons; a statement that sent up the price of 'steel common' in spite of the Government suit and the House investigation.

**Revision of the Mining Law** is being proposed in several particulars, but Congress is likely to be too busy with politics to do anything radical. The Bureau of Mines has asked for minor changes in the law governing its activities, and as this is favoured by mining men who have been consulted, it may be granted. Something is likely to be done in the way of a leasing system for Alaska coal lands since practically all parties now agree on that plan. The President's proposal of a general leasing system for mineral lands is not likely to be adopted at this time. Revision of the wool schedule in the tariff is almost sure, and following that an attempt will be made to re-write the metal schedule though in the judgment of those best informed no change is likely at present.

[A proposal that the Government should itself operate a coal mine in Alaska was made by the editor of the *Mining and Scientific Press*. It has been widely endorsed.]

*A Pack-Train from a Colorado Mine.*

## JOHANNESBURG.

**The Shortage of Native Labour** combined with the 'big-tonnage-milled' policy is giving rise to a grave condition of affairs which seems hardly as yet to be realized. The big-tonnage-milled policy, the idea of which is to reduce the working cost per ton milled and thus bring large quantities of low-grade ore within the economic limit, might have been satisfactory had the native labour available been sufficient and capable of expansion in the same proportion as the output. Had it been possible to increase the tonnage broken by hand-labour, at the present time, in the same proportion to the total tonnage broken as was formerly the case, the average recovery per ton for the Rand would not have decreased so rapidly neither would the working cost per ton milled show such an increase and the profit such a decrease. It is impossible to do the same clean mining with machine-drills as can be done by hand-labour, except in the few cases where the width of the lode is much above the average. Generally speaking, in machine-stopes a larger percentage of waste is broken than in hand-stopes, and, also, the waste in machine-stopes is shattered into such small particles that close sorting is rendered inefficient. In addition, the increasing number of machine-drills used is also increasing the amount of dangerous dust made under-ground. It is difficult with machine-drills, especially with those of the hammer-type, to prevent larger quantities of dust from getting into the air than was the case in the past, when machine drills were used chiefly for development and more stoping was done by hand-labour. In October 1909 there were an average of 2846 machine-drills in use, while in October 1911 the average number was 4435. The result is seen from a comparison of the following figures, showing the average for the year 1909, as against October 1911.

| | Percentage of waste sorted. | Recovery-value per ton milled. | Working-cost per ton milled. | Profit per ton milled. |
|---|---|---|---|---|
| Year 1909... | 14·45 | 28s. 11d. | 17s. 1d. | 11s. 6d. |
| Oct. 1911... | 12·98 | 27s. | 18s. | 9s. 1d. |

To these unsatisfactory results it must be added that the scourge of miner's phthisis shows no abatement, but rather the reverse. The mining industry of the country is thus at present faced by the fact that little improvement can be expected under the existing conditions which make it practically impossible for a sufficient supply of native labour to be obtained.

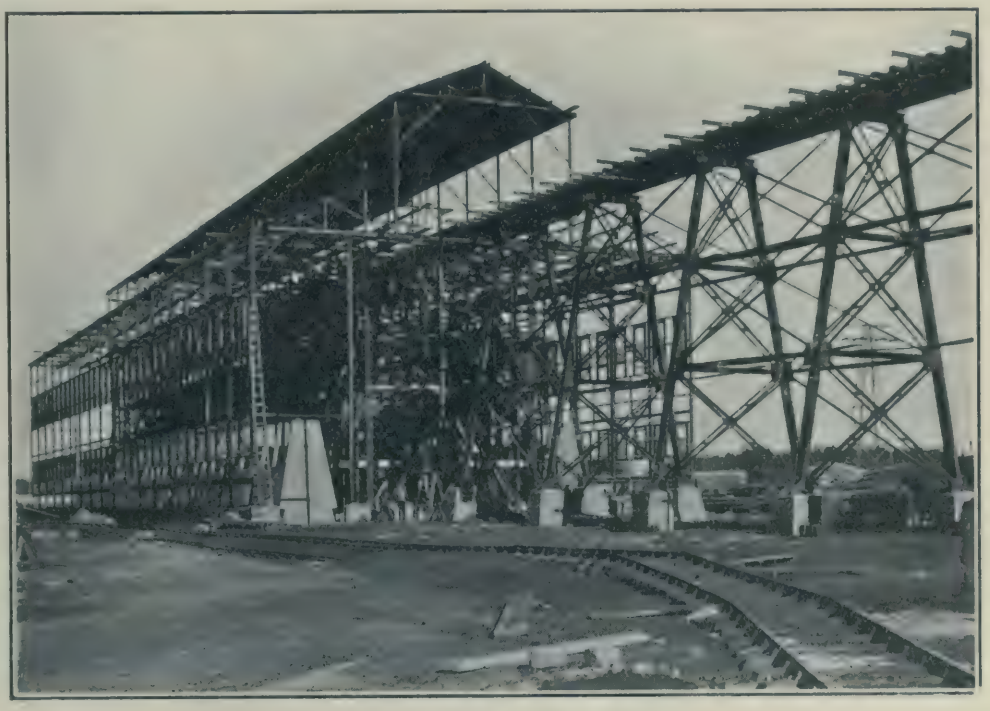
**The Year 1911.**—A few points of interest concerning the gold mining industry of the Transvaal during the past year may be noted. The Chamber of Mines statistics give the total output for 1911 as 8,237,723 ounces of fine gold valued at £34,991,620. This constitutes a record. The increase in output over 1910 is 703,880 ounces, valued at £2,989,885. The profits, however, have fallen. The number of stamps running at the end of the year was 10,195, and the number of tube-mills 253, as against 9736 stamps and 190 tube-mills at the end of 1910. The East Rand Proprietary fiasco is an unfortunate blot on the mining record for 1911. The shortage of labour caused an increase in the number of machine-drills used underground. Costs have gone up. Several mines commenced crushing during the past year, notably the City Deep, Modder B, and Brakpan. During 1911 an unusually large number of changes in the personnel of the mines took place. On the metallurgical side the introduction of the zinc-dust process, on many of the newer mines, was an outstanding feature.

**Group Organization.**—From recent results at various mines, it would seem that there is room for improvement in the way in which the underground work is watched by consulting engineers and general managers. In comparing the way in which the surface works, consisting of the reduction plant and the mechanical engineer's department, are supervised by their respective consulting men, it is noticeable that there is practically no supervision by consulting engineers of the underground operations. Underground everything is left to the resident managers, many of whom have had no undergound experience in this country at all, and in any case the managers do not spend the same amount of time underground as they do on the surface. If it is necessary to have consulting metallurgists and mechanical engineers visiting the mines and continually keeping in touch with all that goes on at the surface, it is certainly of greater importance for consulting mining engineers to keep in touch with what is going on underground, otherwise than by obtaining a general idea of the workings from the mine plans. Taking it for granted that consulting mining engineers devise the general scheme of development, they should certainly see that their instructions are being properly carried out. Under the existing system of organization, the consulting engineers have not the time to spare in order to keep in touch with the conditions in the mines under their control. It would therefore be a step in the right direction if special men were appointed—possibly as assistants to the chief consulting engineers—who would constantly go underground and report on the progress and condition of the workings. This would lead to the standardization of the best methods of doing the various classes of work. At present the underground departments of many mines are run year in and year out on old conservative lines simply because those responsible, mine captains and shift-bosses, have no opportunity of visiting other mines to see how it may be possible to improve on their own methods.

**The City Deep** calls for some comment. In March 1911 it was stated by the chairman of the company, R. W. Schumacher, that the mine was then ready to produce 40,000 tons per month. Up to the present, the largest tonnage crushed, for any one month, was in November, when 41,290 tons were put through the mill. Of this 25% came from the development dump, only about 30,000 tons being mined during the month. This is another example of over-estimation, by the former technical staff, which in some ways recalls to mind the mistake recently made at the East Rand Proprietary. Over-capitalization, where it occurs, seems to lead those in control to expect a greater profit, hence a larger tonnage milled in a given time than even the largest mines can attain until considerable time has elapsed after the initial development. The mines are expected "to run before they walk." The development has to be curtailed, so that stoping can be pushed further ahead when crushing begins. In such cases after a time the mine becomes short of working-faces. This difficulty seems to have troubled the City Deep, in addition to shortage of native labour and in the power supply, which limits the use of machine-drills. The City Deep is now paying for the bad work done in the earlier stages of development, such as badly graded drifts, inadequate shaft-stations, and unsatisfactory pump-chambers. The underground department has been poorly managed in the past, and bad work in this department, when continued over a long

period, takes a still longer period to rectify, apart from the extra expense involved. With the mine itself in a bad condition, the reinforced concrete in the mill giving trouble, and another change in the management of the mine (M. O. Tillard being now the manager in the place of James Morris) the City Deep for the present, and for some while to come, must be expected to give results far below those anticipated. But any mine with an ore-reserve of the quantity and quality of that of the City Deep, estimated at 2,273,187 tons of 8·2 dwt. ore, at the end of 1910, must eventually pay good dividends even on a capital of £1,250,000.

reserve. This may either be due to a selective policy on the part of the management or to the fact that errors in estimating the value of the ore-reserve may easily occur in a mine developed on the big-block system. If the latter reason be the cause, the error is fortunately for the present on the right side, as more gold has already been obtained than is called for. The wise course of establishing a gold reserve has been adopted. This reserve already amounts to 2559 oz. Underground, with a comparatively flat dip and big blocks (1000 by 750 ft.) the handling of the broken ore may afford some difficulty, unless systematic waste-packing is resorted to, in sup-



*TRESTLE APPROACH TO CITY DEEP MILL.*

**Modderfontein B** has just come into the list of productive mines and has made a favourable start. The 80 stamps and 5 tube-mills, up to the end of November, crushed a total of 47,360 tons, which yielded 18,563 oz. fine gold or 7·83 dwt. per ton crushed. At the end of 1910 the ore-reserve was estimated at 2,788,000 tons averaging 7·0 dwt., which together with 610,000 tons of "unpayable ore" of an average of 3·4 dwt. per ton made a total of 3,398,000 tons averaging 6·4 dwt. The grade of the ore mined up to the present is therefore much above the average of the ore

port of the hanging wall above the necessary intermediate tramming-levels. The mine has certainly made a satisfactory start; with a compact surface plant, easy ground for breaking, and the fact that it is an outcrop proposition, there is no reason why the good results already obtained should not continue and, if anything, be improved.

**The Eight Hours** clause embodied in the new mine, works, and machinery regulations, which came into force in December, is worded as follows: "No person employed to perform underground work in any mine shall work, and

no person shall permit any person so employed to work underground, for a longer period than 8 hours during any consecutive period of 24 hours, or 48 hours during any consecutive 7 days, exclusive of the time occupied in going to or from the working place." The Chamber of Mines, in a reply to a letter to the Minister of Mines, asking for information as to the exact meaning of the clause, was informed that on the instruction of the Minister of Mines, in view of the history of the drafting of clause 9 and the intention of Parliament, which was evident during the passing of the Act, the section should provide alternative limitations and should not be read as a double restriction, as has been the case in many other countries. The Government is therefore of opinion that the section should be read in such a way as to provide for alternative methods of the limitation of hours; in other words, that 8 hours per day may be exceeded provided that the total of 48 hours per week is not exceeded. It is fortunate that the Government has seen fit to interpret clause 9 in such a way that the limiting time for underground work is 48 hours per week. This will facilitate matters in the working of the underground departments of the mines, as compared with what would have been possible under a strict 8 hours per day rule. In view of the 8 hours per day clause, an understanding has been arranged between the various mining groups, with the exception of the J. B. Robinson group, as to the standard time for hours of work underground and as to the rate of pay for Saturday shifts. The times for work decided upon are: for the day shift, 7.30 a.m. until 3.30 p.m., all blasting being done at 3.30 p.m.; and for the night shift 7.30 p.m. until 3.30 a.m. when blasting takes place again. On Saturdays work commences an hour earlier, at 6.30 a.m., and finishes at 2.30 p.m. for the day shift; for the night shift, work commences at 3.30 p.m. and finishes at 11.30 p.m. The pay for Saturday shifts will be at the same rate as that for the other week-days. There is much dissatisfaction among underground employees with these standard times especially with regard to the hours of work fixed for Saturdays and to the rate of pay for Saturday shifts. As to the hours of work for Saturdays, there is little advantage to be gained by commencing work an hour earlier than usual, as even on the outcrop mines the men will not be out of the mine until 3 p.m., which spoils the half-holiday to which they have in many cases in the past looked forward; while in other cases where it has been the custom to work for the same hours on Saturday as on any other week-day and to get 1½ shifts' pay for the Saturday shift, the extra ½ shift's pay is now to be stopped. It would have been better either to make the hours of work for Saturdays the same as for the other days, because the night-shift men on Saturdays have to go into much of the noxious fume from the blasting done by the morning-shift men; or as an alternative to make the hours of work from Mondays to Fridays longer than 8 hours and consequently a shorter shift than 8 hours for the morning-shift men on Saturdays, which would give them a half-day off, and at the same time give the mines time to clear from smoke and foul air before the night-shift went into them. The idea of making all the mines blast at the same time, 3.30 a.m. and 3.30 p.m., will need modifying, otherwise the health conditions on many mines will not be improved by the men in the outcrop mines being subjected to the noxious fumes produced by blasting in the deep-level mines. For example all the return air from the Village Deep is exhausted into the Village Main Reef and men working on the latter, especially on the Saturday afternoon shift, must be for some time working in an unhealthy atmosphere.

## MEXICO.

**Production.** — Statistics of the Finance Department for the fiscal year 1910–'11 show that, notwithstanding the political upheaval in Mexico, the country produced more gold and silver than in the preceding twelve months. The gold production is placed at 49,615,289 pesos, an increase of 1,186,447 pesos, and the silver production at 80,913,799 pesos, an increase of 4,508,225 pesos. Copper produced in the fiscal year had a value of 26,300,228 pesos; lead, 6,539,098 pesos; and zinc, 899,925 pesos. There was a slight increase in the output of copper, and decreases in the output of lead and zinc. In the first three months of the present fiscal year—July to the end of September 1911—Mexico produced gold worth 11,189,367 pesos, and silver worth 19,642,706 pesos. Compared with the production in the corresponding quarter of the fiscal year 1910-'11 there was a decrease of 1,198,790 pesos in gold production, and an increase of 619,136 pesos in silver production. In the last five years Mexico's gold production has increased from 36,563,898 pesos in 1906–'07 to 49,615,289 pesos in 1910–'11. Mexico's silver production in the years 1902–'03, 1903–'04 and 1907–'08 exceeded in value that of 1910–'11. That the revolution in Mexico caused heavy exports of

gold is shown by the statistics of the fiscal year, the Monetary Commission alone exporting gold bullion worth 4,422,803 pesos. In addition, Mexican gold coin to the value of 7,144,362 pesos, and foreign gold coin to the value of 1,032,193 pesos, was sent out of the country. The increased price of silver and copper is stimulating production in Mexico, and the present year should be a good one for the mining industry. With the collapse of the Reyes revolution the only serious obstacle to peace in Mexico disappeared, and an optimistic feeling is now general.

*HACIENDA DE GUERRERO, REAL DEL MONTE, MEXICO.*

**Dos Estrellas.**—This famous mine in the Tlalpuhajua district of Michoacan, but generally described as in the El Oro district, continues to be the most important gold producer in Mexico. In 1911 the production totalled approximately 11,000,000 pesos, and dividends of 6,000,000 pesos were paid. Definite figures for 11 months of the year show a revenue of 10,067,697 pesos from 435,317 tons of ore milled, and profits of 5,563,487 pesos. June was the best month, with a production of 1,175,120, but in March and September also the million mark was passed.

**Real del Monte y Pachuca.**—This subsidiary of the United States Smelting, Refining & Mining Co. completed extensive betterment plans late in 1911, and at the close of the year the remodelled and enlarged reduction plants were handling at the rate of 32,000 tons of ore monthly. In 1910 the company averaged 18,000 tons per month. It is announced that within a short time the tonnage will be increased to 36,000 tons per month, giving the company a production of from 10 to 12 million ounces of silver per annum. The underground changes made have enabled the company to double the output of the mines, and at the same time practically cut the tonnage cost in two. The famous old Real del Monte district, to which but little attention was given two years ago, has developed in a surprising manner, and the mines there are at present the most important holdings of the company.

**Power Enterprises.**—The Mexican Northern Power Co., the Canadian concern that will have one of the largest power-plants in Mexico, on the Conchos river in the State of Chihuahua, is unloading steel for a power-transmission line to the important Parral district of Chihuahua. The company has a big force of men at work, and expects to start power delivery next year. Energy will be transmitted to several of the principal mining districts of Chihuahua. The Chapala Hydro-Electric & Irrigation Co. has just completed a 12,000 hp. plant at Puente

Grande, on the Santiago river, 15 miles from Guadalajara, at a cost of over 3,000,000 pesos. This plant will supply the transmission line to the Etzatlan and Hostotipaquillo mining districts of Jalisco, and any other lines that may be built. The Guanajuato Power & Electric Co. has completed a third power-plant, on the Angulo river in Michoacan, and its power supply has been doubled in consequence. The company has entered into a contract to build a 50-mile transmission line to the Pozos mining district of Guanajuato. In the first 10 months of 1911 the Mexican Light & Power Co. had gross earnings of 5,793,852 pesos, an increase of 572,985 pesos, and net earnings of 3,892,412 pesos, an increase of 214,158 pesos. In the same period the Pachuca Light & Power Co., a subsidiary, had gross earnings of 962,009 pesos, and net earnings of 597,452 pesos.

**Oil.**—The Doheny interests announce that they now have contracts covering the sale for future delivery of approximately 55,000,000 barrels of oil, and that they will receive an average price of 48 cents per barrel, equivalent to more than $26,000,000. During the present year they expect to market 24,000 bbl. daily, and it is estimated that the year's revenue from these sales will amount to $4,200,000. The principal Doheny concerns are the Mexican Petroleum Co., of Delaware, a parent company, and the Mexican Petroleum Co., of California, and the Huasteca Petroleum Co. The Doheny concerns control about 600,000 acres of land in the States of Veracruz, Tamaulipas, and San Luis Potosi, 75% of which is owned, and the remainder held under leases. At the end of 1911 the Doheny interests had storage for nearly 8,000,000 bbl., and this is to be increased to 10,000,000 bbl. The present producing capacity of the Doheny wells is estimated at from 60,000 to 70,000 barrels per diem.

**Mexican Searchers, Ltd.**—This British syndicate, controlled by the Bechuanaland Exploration Co., has taken possession, under a working bond, of the Pinavete properties of the Maduro Mining Co., in the Jora district of Tepic. The principal mine of the group is the San Jose de Ventanas, a famous *antigua* of Western Mexico. The workings of this property are extensive, and there is actually assured a big tonnage of ore that will mill profitably. The British syndicate has started new development. The deal is said to involve nearly 1,000,000 pesos.

[Reference is made elsewhere to the renewed activity of the Zapata movement in Chihuahua, Guerrero, and Morelos.—EDITOR]

## SAN FRANCISCO.

**Petroleum.**—Estimates of production in the various oilfields of the United States are now available. The figures compiled by the United States Geological Survey are as below:

| | 1910 Barrels | 1911 Barrels |
|---|---|---|
| Appalachian field | 31,985,515 | 28,000,000 |
| California | 73,010,560 | 81,000,000 |
| Kansas and Oklahoma | 53,157,386 | 56,000,000 |
| Louisiana | 6,841,395 | 10,000,000 |
| Texas | 8,899,266 | 9,000,000 |
| Miscellaneous | 35,661,926 | 33,000,000 |
| Totals | 209,556,048 | 217,000,000 |

The total here credited to California is probably larger than is correct, due perhaps to failure to deduct the amount used in the field and lost in transmission. The *Mining and Scientific Press* has published the following figures for the gross production, less the amount used on each field in drilling, pumping, and other processes incidental to the industry.

| | Barrels |
|---|---|
| Midway | 20,821,669 |
| Coalinga | 17,793,221 |
| Kern River | 12,225,273 |
| Santa Maria | 6,259,766 |
| Fullerton | 5,887,069 |
| McKittrick | 5,339,364 |
| Maricopa | 4,468,087 |
| Salt Lake | 2,815,097 |
| Whittier-Coyote | 1,106,966 |
| Ventura | 453,764 |
| Los Angeles | 436,200 |
| Newhall | 139,508 |
| Summerland | 64,875 |
| Lost Hills | 63,500 |
| Total | 77,874,359 |

From the total here given it is proper to make a still further deduction of 650,000 bbl. for loss in transmission. Shipments for the year are figured at 66,665,000 bbl., which leaves a net gain in surplus of 10,559,359 bbl. The total stock of oil on hand is now about 40,000,000 bbl. and it is this enormous surplus that has at the same time forced prices to a discouraging level and permitted a wide extension of the market. It was not only a low price but the assurance of a supply that steam-users demanded before changing from coal to oil. They have now every reasonable assurance on the latter point. At present oil is the dominant fuel from Alaska to Panama, and as far inland as eastern Nevada. Overseas markets and the market aboard Pacific steamers continue to expand. This, of course, can not go on indefinitely; probably California oil is now dominant over nearly as wide a region geographically as is desirable. Within

the area where it is sold there are still steam-plants to be converted and there is an important market yet to be won among domestic users. The oil industry cannot, however, permanently prosper at present prices. Within the past year acceptance of fuel-oil at 30 c. per bbl. has been refused by the Associated, and the price, in fact, was but little above that figure except during the first few months of the year. Producers have set their hopes on 50 c. per bbl. at the well, but for the present no definite means for securing this advance is at hand unless the United States Government takes the radical step of compelling the capping of all wells on disputed ground until titles are adjudicated. Any such action would change the situation over-night. Despite the discouragingly low price for oil the industry continues profitable. Dividends paid by California companies in December amounted to $820,070.

**Zinc,** which has long been the despised mineral of the West, is coming into its own. The zinc industry of Leadville has been important for a decade. In Utah a profitable business has been done for about half as long and from Good Springs in Nevada, and Kelley in New Mexico, shipments have been important for several years. More recently Butte has attracted attention and it is now generally recognized among zinc specialists that a large production may be expected from there. In California zinc has been known at a number of points but no one has considered it worth much. California has never shipped much lead ore and the old rule that zinc was to be found with lead has prevented anyone making much of a search. Carbonate of zinc occurs at Cerro Gordo and has been shipped. Probably much more will be sent out from that old district when its value is fully recognized. In Shasta county blende has been constantly found in the copper mines, but whenever drifts ran into zinc ore they were apt to be abandoned and development directed in some other direction. In this incidental fashion a considerable amount of zinc ore has been partly developed. Estimates are naturally vague but it is probably not far wrong to say that a million tons of ore containing 30% zinc is readily available in two properties for which figures are at hand. The ore, however, is complex. It contains zinc, iron, and copper, with a little gold and silver. The first use made of it was at the Mammoth mine, where, by the Sprague process for neutralizing smelter fume, part of the zinc is utilized. This, it may be noted, is a development that harks back to the early days of zinc smelting in the United States. The Wetherill grate, developed originally for making zinc oxide from raw ore, was used by Bartlett at Canyon City in making a zinc-lead pigment at the same time that he recovered the gold and silver in a copper-bearing cinder left on the grate. From this to the practice in Utah and at Mammoth, primarily designed to permit smelting of copper ores, was a logical step. The process, as used in California, however, does not permit ores to be worked for their zinc

*A Residence in Arizona.*

value, and the necessity for something of that sort is now recognized. The Minerals Separation American Syndicate has been studying the situation and doubtless will have a solution to offer. In the meantime J. B. Keating, at Bully Hill, has been conducting experiments along several lines of electric smelting and is now building a plant designed to test one of the processes on a commercial scale. Another line of experimentation has been carried on by C. J. Reed at San Francisco. His is an electrolytic process, in which the difficulty involved in the electrolysis of zinc salts

in an acid solution has been simply overcome by the use of a neutral electrolyte. An experimental plant upon a commercial scale is now in process of construction near Palo Alto, and in the course of a few months exact data as to operation and cost will doubtless be available for publication. Altogether the probability of development of a zinc industry on the Pacific Coast is now good.

**Potash.**—Germany has long had a monopoly of the potash industry and, as is well known, there has been much friction, especially in the last two years, between American users and German producers. The merits of the controversy are not for me to discuss, but one important result is worth noting. Stung by what Americans generally considered unfair treatment by the Germans, a deliberate search for domestic sources of supply was undertaken by the United States Government. Appropriations were made to both the Geological Survey and the Bureau of Soils, for the purpose of discovering new deposits or new methods of using known potash-bearing rocks. The search is still under way, but it is possible already to report the finding of at least two deposits of probable economic importance. The first is in the Leucite Hills of Wyoming. Here there are large bodies of lava that contain an average of over 10% $K_2O$. The extent and distribution of the potash-bearing rock has been determined by the Geological Survey and efforts are now being made to develop a commercial process for its utilization. Considering that the richer manufactured fertilizers contain but 2% of potash and that as they are now made a waste filler is always used, this does not seem impossible. A second probable source of supply has just been announced in a special bulletin issued by the Geological Survey and describing a true vein of alunite occurring near Marysvale in southern Utah. The vein has been traced 3500 ft. with strong probability of its extending farther. The width is as much as 20 ft. with an additional 6 ft. in a parallel vein. Engineers of the Survey estimate on the basis of present development that one-sixth to one-seventh of present importations can be supplied for each hundred feet of depth on the known ore-shoot. The outcrops range from 9900 to 11,000 ft. in altitude and, while the Survey officers are careful to point out that this does not involve necessarily an equivalent extent of mineral in depth, there is evidently a considerable tonnage present. The production of commercial potash salts from alunite interposes no great difficulties and the vein contains 11% of $K_2O$. The Survey has issued a description of the occurrence, with a compilation of notes on other known occurrences of alunite and simple rules for field testing of suspected material. As alunite has been found at many points of the West it is likely that other bodies of commercial importance will be discovered. To mining men the mineral is principally known because of its association with the rich ore at Goldfield. In the meantime the search for still other sources of supply is being pushed. The Geological Survey has drills at work prospecting the material underlying the great extinct lakes of Nevada and Utah and it is not impossible that a second Stassfurt may arise in the desert.

## MELBOURNE.

**A review** of the mining industry for the past year will be timely. The fates have not worked kindly for gold mining either in Western Australia or in the Eastern States. Copper mining has been affected by the low price of the metal and the slowness with which the large progressive mines in North Queensland can be provided with equipment and connected by railway. The smelting difficulties at Mt. Morgan and labour troubles at Mt. Lyell have affected the outputs of those great properties, and at the Great Cobar mine the low grade of the ore and financial worries have upset original estimates. Broken Hill, on the other hand, has been doing well owing to the improvements in the flotation processes, the developments at the British mine, and the high price of metals. The hope exists that before the end of next year Mr. G. D. Delprat's visit to Europe and the United States on behalf of the Broken Hill Proprietary Co. will result in some development in connection with the iron-smelting industry. The proposed construction of the railway from South Australia to Western Australia gives the company the opening to start the manufacture of steel rails should it desire to embark on this enterprise. So far as the other metals go, the Mt. Bischoff seems to have renewed its youth, especially as it has the advantage of a splendid market for tin to help it on its way.

**The Northern Territory,** which was lately taken over by the Commonwealth from South Australia, as Federal territory, represents a block of country as big as France. It extends from the tropics to the sub-tropics and has been painted by a group of Federal members as a land flowing with milk and honey. In point of fact it is nothing of the kind. For

about three months of the year it has equable climate. For the rest of the year it is hot and drought-stricken. There are large plains and rich river flats and rolling downs, but by far the greater portion of the territory is fit only for grazing. The hope was entertained that it would prove rich in minerals. So far the search has been futile, for the orebodies are short and barely remunerative. An official report by the Warden, now published, shows that in the past five years the mineral output has fallen from £126,000 to £61,000. The statement is made that this arises from the ownership of mines by Chinese. It is hard to see the force of this assertion, for in Victoria the presence of Chinese as owners did not retard the industry in the least. The truth lies more in the fact that the extent of the deposits is so small as to be attractive only to the richer Chinese, who can practically commandeer the services of their poorer countrymen. Still, the Northern Territory is so vast that its failure as a mineral field for the present does not mean that no future exists for the outlying country.

*SUPPLYING ORE TO THE BLAST-FURNACES AT PORT PIRIE, AUSTRALIA.*

**Broken Hill.**—The most surprising act of combined labour in this so-called free land of ours was committed at Broken Hill a few days ago. A miner lost his life while at work in one of the mines, thereupon the call went round the unions "to down tools" out of sympathy with the bereaved. The result was the almost complete cessation of work by the mining population of the important district until after the funeral. Organized labour elsewhere views the proceedings with mixed feelings. Socialists applaud; but others ask "What next?" An immediate result is that the Mine Managers' Association of Broken Hill has called upon the Grievance Committee of the Amalgamated Miners' Association to justify the action or to admit that it constitutes a grave breach of the Federal award that determines labour conditions at the Barrier for the next three years. The actual monetary loss to the men runs into a large sum, but the inconvenience to the companies, to say nothing of the effect on discipline, must be most marked. Still the mine managers are powerless to act. Labour is so scarce and the men so independent that they can flout the managers without fear of serious reprisal. Of course, some of the mines are only reaping the reward to which they are entitled. They permitted dissension to creep among the ranks of the owners when the wage agreement was being fixed and so prevented the possibility of a united front being presented to the unions. These bodies have learnt to take full advantage of the position. The idea of a

whole army of men throwing down tools for a day because a man with whom the majority were absolutely unacquainted had met with a fatal accident, may be an example in altruism, but to the practical the idea certainly suggests itself that the better thing to have done would have been to have worked on and given the proceeds of the day's work to the family of the deceased. What employers now have to fear is that at any time this example may be followed with an absolute disregard of all interest save that which prompts such a sentimentality.

**Bendigo.**—Only one of the big goldfields has furnished its return for 1911. This is Bendigo, where a close record is kept of all outgoings and incomings. The results of the year compare with those for previous years as follows:

| | Gold. oz. | Dividends. £ | Calls. £ |
|---|---|---|---|
| 1906... | 223,733 | 246,254 | 221,262 |
| 1907... | 196,944 | 122,017 | 208,779 |
| 1908... | 193,153 | 126,268 | 135,923 |
| 1909... | 213,681 | 159,865 | 110,762 |
| 1910... | 182,318 | 96,289 | 119,057 |
| 1911... | 175,684 | 123,515 | 161,356 |

These figures tell a tale. It is one for which the observations of Mr. T. A. Rickard have prepared the way. The last few years have seen the disappearance from the list of dividend-payers of a number of the deep mines. This arises from the fact that the shoots of gold at depth do not carry the same metal contents as in the upper levels, nor are they of the same extent as those nearer the surface. As a consequence the supporters of the district are abandoning the deep mines and prospecting the side 'lines,' which so far remain practically virgin. It is the additional capital that has gone into these that has brought up the calls for the year and added to the dividends, despite the smaller output of gold from the district. The current twelve months should see a much better return from the side lines of reef than heretofore, as the result of the expenditure on the claims should then be manifest.

## CAMBORNE.

**Falmouth Consolidated.**— Toward the end of January a large proportion of the underground force was discharged from the Wheal Jane mine belonging to this company, as a result of the flooding of the workings through the breakdown of one of the pumps. It is expected that the stoppage will only be temporary, for a new pump is on order. This company has been unfortunate. It will be remembered that three years ago it was found that the ball-mills were a failure, and had to be replaced by a Californian battery.

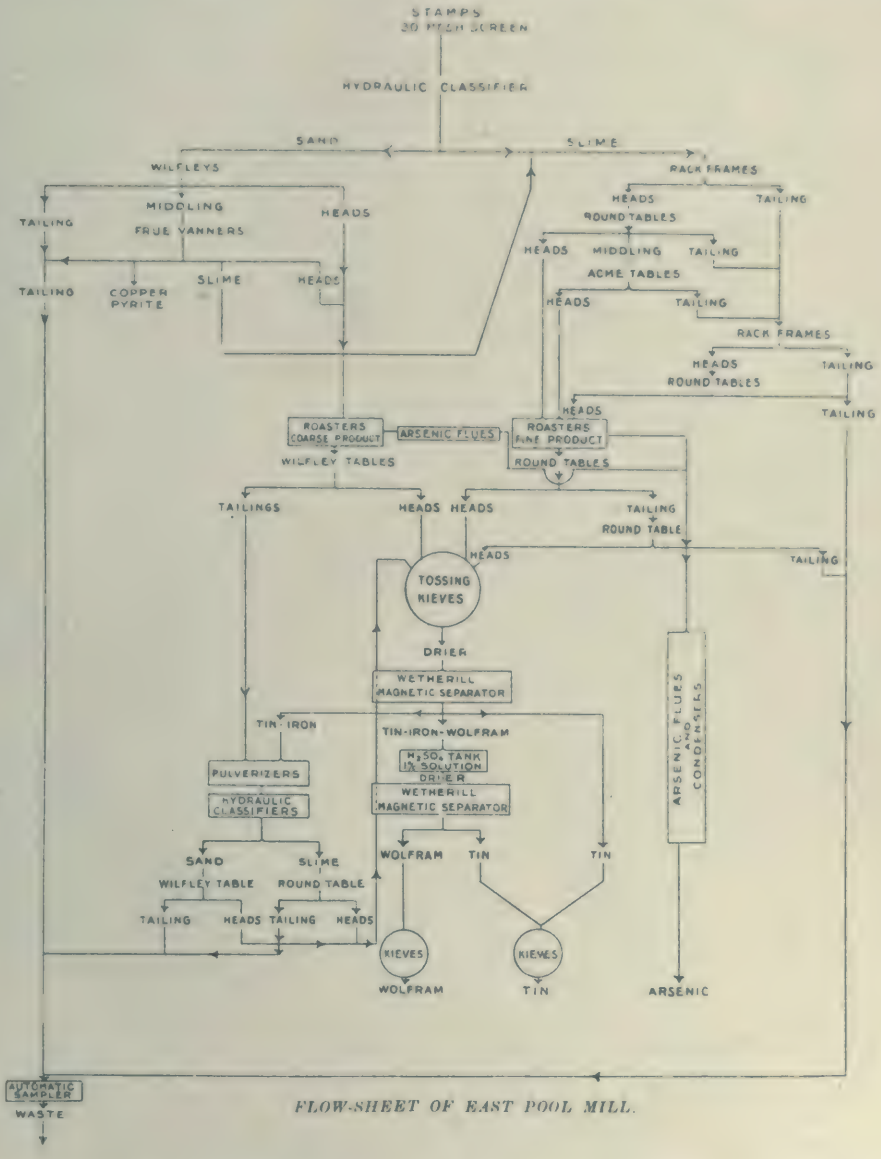
**South Tolcarne.**— The sand dumps on this property have recently been acquired by a small company, the engineers to which are Twite & Steinhart. Tailing dumps in Cornwall are now in demand owing to the success of the Cornwall Tailings company in treating the Carn Brea sand.

**Wheal Kitty & Penhalls.**— After having shown continuous profits since 1907, this company has at last had a lean half-year, for a loss of £305 is reported for the six months ending December 31 last. The cause of this loss is obvious from the report, for it appears that the produce has dropped from 28 lb. for the first half of 1911 to 19·9 lb. for the six months under review. Fortunately the price of black tin was well maintained, or the position would be serious. The southern section of the Stamps lode has been a great disappointment. When intersected in the south cross-cut from Sara's shaft last July, the lode had a most promising appearance; so much so, that at the shareholders' meeting last August the speakers permitted themselves to paint the discovery in rather too glowing colours. However, these ups and downs are to be expected in the St. Agnes district. It is satisfactory to see that the recovery is again on the up-grade, for at the last ticketing seven tons was offered for sale, which is the best fortnightly return since June last. The following figures for the six months ending December 31, 1911, are of interest:

| | |
|---|---|
| Tinstuff treated | 8384 tons |
| Black tin sold | 74½ „ |
| Average recovery | 19·9 lb. |
| Total receipts | £8512 |
| Average price per ton | £114 |
| Average value per ton milled | 20s. 3d. |
| Working cost | 21s. 2d. |

**East Pool & Agar.**—The accounts for the three months ending December 31 last showed a net profit of £749, which enabled the adverse balance of the previous quarter, amounting to £402, to be wiped out, and £347 to be carried forward. This is the first time since 1907 that the company has made a profit. It is noteworthy that for the first time in the history of the mine, the accounts have been audited by a public accountant. There was a good deal of talk at the shareholders' meeting about dividends in the near future, but any division of profit would be absolute folly, seeing how the development of the property has been neglected for many years past. All the money

that is likely to be made for the next few quarters should be devoted to vigorously developing the mine, so as to raise the grade and enable the management to face with equanimity a fall in the price of tin. For last quarter, the average recovery was 19·25 lb. of tin and wolfram per ton, and the price received




*FLOW-SHEET OF EAST POOL MILL.*

for the company's black tin averaged close on £114 per ton, so a drop to £100 per ton for black tin would necessitate calls unless the grade improved. The development for the past quarter was only 276 feet and the tonnage milled 17,337, so that the footage was only 1 foot for every 62 tons milled. The

receipts were £17,317 or 19s. 11d. per ton milled, while the costs were £16,568 or 19s. 1d. per ton. By favour of the manager, Joseph Jennings, we are able to present a flow-sheet of the dressing operations at these mines. The chief products are tin, wolfram, and arsenic, and the plant, being comparatively new, is a good example of modern Cornish practice in dealing with complex ores.

**Cornwall Tailings Co.**—According to the monthly reports, it appears that this company in 1911 treated 59,855 tons of tailing, the production of black tin being 257·7 tons, realizing £24,712, or 8s. 3d. per ton treated. The total

working costs amount to £10,083 or 3s. 4d. per ton, so that the profit is estimated to be £14,629, equal to 4s. 11d. per ton treated. A third tube-mill has recently been put into operation, and a fourth is in course of erection, and judging from past experience, the result of these additions should be an increased recovery.

**Levant.**—The statement of account presented to the adventurers by Major Freathy Oats on January 16 for the 16 weeks ending December 23, 1911, showed a profit of £1604 as compared with £2430 for the previous four months. This difference is chiefly accounted for by the reduced quantities of copper and arsenic produced, the fall in the production of tin being infinitesimal. The receipts amounted in all to £15,313, and the expenditure, including £545 for royalties, to £13,709. Thus on a tonnage treated of 8709, the receipts averaged 35s. 2d., the cost 31s. 6d., and the profit 3s. per ton milled. A dividend of 7s. 6d. per share was declared, absorbing £882. 15s., leaving £3503 to be carried forward. It will be noted with satisfaction by most people that a reserve fund is gradually being built up against the day when the sinking of a new shaft will have to be undertaken.

**Dolcoath.**—The output of tin concentrate at Dolcoath has been curtailed during the last six weeks owing to an increased flow of water in the bottom levels, and the amount sold at the fortnightly ticketings has been about 45 tons as compared with the accustomed 60 tons. At the last ticketing on February 8, the amount for sale showed a slight increase, the figure being 56 tons. The water trouble has not been the only cause of this temporary fall, as the changing from the old Cornish stamps to the new battery of Holman air-cushion stamps has interfered with the regular working of the mill.

**South Crofty.**—The report of this company for the year 1911 affords most gratifying reading not only to shareholders but to all who are interested in tin mining. Every item of the accounts shows an advance, the total production of tin, wolfram, and arsenic, the yield per ton of all three products, and the income and profit. Naturally the high price of tin has also been in the company's favour, but on the other hand the prices realized for wolfram and arsenic have been slightly lower. The mill treated 63,882 tons of ore during the year, and the recovery was 677 tons of black tin which sold for £76,587, 148 tons of wolfram selling for £14,717, and 1008 tons of arsenic products selling for £9518. The total receipts were £100,822, and the receipts per ton 31s. 6d. The yield per ton of ore was 23·76 lb. black tin, 5·22 lb. wolfram, and 35·36 lb. arsenic products. As compared with 1910 the yield showed an increase of 47 tons black tin, 22 tons wolfram, and 272 tons of arsenic products, and the receipts per ton of ore treated were 6s. higher. The profit for 1911 after allowing for depreciation and all other expenses was £31,981, out of which £17,500 was distributed as dividend, being at the rate of 35% on the nominal capital, and £10,000 was placed to reserve. This dividend of 35% is of course a handsome one, but it must be remembered that when the present company was started five years ago outsiders paid £4 each for the £1 shares, so that their return is only 8¾% on their money.

**Grenville United.**—The profit earned during the six months ended December 31 last amounted to £10,734, after allowing £1000 for depreciation of plant and machinery. Out of this profit, the Board recommend dividends of 1s. on the fully-paid, and 3d. on the partly-paid shares, which will absorb £6751, and after allowing for the interim dividend paid last August, a sum of £2533 is carried forward. The total dividend on the fully-paid shares amounts to 1s. 4d. for the half-year, or at the rate of over 29% per annum, which is certainly a fair return, and should induce investors to turn their eyes to Cornwall. The following comparison shows clearly that Captain Battens, released from his worries of dealing with water troubles, has devoted his attention, with considerable success, to more vigorously developing the mine, to increasing the tonnage handled, and also to improving the recovery. However, there is still a good deal of leeway to be made up in the matter of development, for in 1908 it was one foot to every 14 tons crushed, while the tonnage dealt with in 1909 reached 42,500. It may be that better selection underground accounts for the smaller tonnage; if so, Capt. Battens is following the fashionable policy in Cornwall.

| | 6 months ending June 30, 1911 | 6 months ending Dec. 31 1911 |
|---|---|---|
| Tonnage milled | 17,059 | 19,306 |
| Tons of black tin sold | 255 | 331 |
| Average recovery | 35 lb. | 38 lb. |
| Average price per ton black tin | £118. 8s. | £118. 5s. |
| Development footage | 514 ft. | 845 ft. |
| Do. per ton milled | 1 to 33 | 1 to 23 |
| Total receipts per ton | 37s. 3d. | 40s. 9d. |
| Total working costs per ton | 29s. 1d. | 29s. 7 |

# DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

## Concentration and Cyanidation.

The Editor:

Sir—In your current issue Mr. G. A. Denny states a case in favour of part concentration and cyanidation, as opposed to entire cyanidation, the comparison referring to cases where treatment of the whole by cyanide is not adversely affected by the presence of the concentrate.

From the concentration point of view Mr. Denny brings forward the following figures, founded on Pachuca practice:

| | £ | s. | d. |
|---|---|---|---|
| Cost to produce 1 ton of concentrate ..... | 10 | 0 | 0 |
| Freight and treatment..... | 2 | 2 | 0 |
| Loss in treatment..... | 6 | 0 | 0 |
| | £18 | 2 | 0 |
| Total silver produced from 1 ton of concentrate ..... | 1140 oz. | | |
| Cost to produce 1 oz. silver..... | 3·83d. | | |

I cannot see why the "loss in treatment" of 5% of the assay-value, which I presume is the deduction made by the smelter, should be deducted from the actual contents, and at the same time appear in the cost of production of the concentrate. Unless a 10% deduction is under consideration a simpler method of stating the case would have been as follows:

REALIZATION OF VALUES IN 1 TON OF CONCENTRATE.

| | £ | s. | d. | | oz. |
|---|---|---|---|---|---|
| Production cost... | 10 | 0 | 0 | Assay-value..... | 1200 |
| Freight and smelter treatment... | 2 | 2 | 0 | Treatment loss 5%..... | 60 |
| Total cost ... | £12 | 2 | 0 | Balance ... | 1140 |

From which it would seem that an expenditure of £12. 2s. 0d. results in a realization of 1140 oz.; or at the rate of 2·5d. per ounce.

In the case of direct cyaniding Mr. Denny gives the following figures:

| | Per ton s. | d. |
|---|---|---|
| Cost of cyaniding, precipitating, and melting | 4 | 6 |
| Refining cost..... | 2 | 3 |
| Loss in treatment ..... | 5 | 6 |
| | 12 | 3 |
| Total fine silver produced from 1 ton of ore... | 27 oz. | |
| Cost per oz. of fine silver produced..... | 5·44d. | |

Presupposing that the original value of the ore was 30 oz. and not 20 oz., as stated, again I cannot see why the "loss in treatment" should be deducted from the assay-value and at the same time be added to the cost of treatment. Again, the refining cost is paid, not on the original amount of metal in the ore, but on the amount recovered. Hence, on the basis of 0·89d. per fine oz., the refining cost per ton is 2s., and not 2s. 3d. as stated. The case could have been presented in a clearer and more correct manner as follows:

REALIZATION OF VALUES IN 1 TON OF ORE BY CYANIDING.

| | s. | d. | | oz. |
|---|---|---|---|---|
| Treatment cost..... | 4 | 6 | Assay-value ..... | 30 |
| Bullion refining cost | 2 | 0 | Residue-value ..... | 3 |
| Total..... | 6 | 6 | Recovered ..... | 27 |

From which it would seem that an expenditure of 6s. 6d. would be the allowance for the recovery of 27 oz.; or at the rate of 2·9d. per ounce.

By adopting this line of argument it might be said that conditions are slightly in favour of concentration, rather than cyanidation. But the comparison is obviously unfair since the question under discussion is not cyanidation as against concentration but cyanidation against concentration and cyanidation. Hence the statement of concentrate returns should be added to a statement of tailing returns, after cyanidation of the latter, and the two should be averaged to demonstrate whether any advantage is gained by shipping the concentrate, and not treating it with the ore.

The following estimate is based on Mr. Denny's figures, and refers to the case where the concentrate is shipped to the smelter, and the tailing cyanided. A 200-ton lot is taken, an amount yielding 1 ton of concentrate.

| | Per ton |
|---|---|
| Total contents of 200 tons of ore at 30 oz. | = 6000 oz. |
| producing 1 ton of concentrate at 1200 | „ = 1200 „ |
| leaving 199 tons of tailing at ... 24·1 | „ = 4800 „ |

By allowing for a cyanide extraction of 88% of the tailing-value, the following estimate can be made:

CONCENTRATE, 1 TON.

It has already been shown that, in the handling of 1 ton of concentrate, an expenditure of £12. 2s. results in the realization of 1140 oz.; or at the rate of 2·5d. per ounce.

TAILING, 199 TONS.

| | £ | s. | d. |
|---|---|---|---|
| Treatment cost (4s. 6d. per ton) ..... | 44 | 15 | 6 |
| Bullion refining cost (0·89d. per oz.). ..... | 15 | 13 | 3 |
| Total ..... | 60 | 8 | 9 |

| | | |
|---|---|---|
| Assay-contents .....4800 oz. | = 24·1 oz. | per ton |
| Residue-value, 12%..... 576 „ | = 2·9 „ | „ |
| Recovered..... 4224 oz. | = 21·2 oz. | per ton |

or a combined cost for concentration, cyanidation, and realization in both cases, of £72. 10s. 9d. will allow for the double treatment

of 200 tons of ore returning 5364 oz. fine silver; or a realization cost of 3·25d. per fine ounce.

By treating the 200 tons of ore without concentration, and still using Mr. Denny's figures, we have:

200 TONS OF ORE.

| | £ | s. | d. |
|---|---|---|---|
| Total cost of cyanide treatment (at 4s. 6d. per ton) | 45 | 0 | 0 |
| Bullion refining cost (at 0·89d. per oz.) | 20 | 0 | 0 |
| Total cost | £65 | 0 | 0 |

| | |
|---|---|
| Assay-contents | 6000 oz. |
| Residue-value, 10% | 600 „ |
| Recovered 90% ... | 5400 oz. |

Or a total cost of £65 to recover 5400 oz.; or at the rate of 2·9d. per fine oz. recovered, a conclusion reversing the original estimations, and showing a result in favour of simple cyanide treatment; as opposed to unnecessary concentration, the shipping of the concentrate to the smelter, and the cyanide treatment of the residue. The difference in favour of the single treatment is about 9½d. per ton, together with a slightly higher extraction.

Further comment would seem unnecessary, but Mr. Denny's figures are based on a statement that infers that the ordinary grade of bullion produced from a 30 oz. silver ore averages only 900 fine. In this respect I consider that he unduly favours the case for part concentration, since my own experience in the treatment of an ore of similar value in another part of Mexico resulted in the production of 970 to 980 fine bullion, not in isolated cases but in large shipments, the assays checking with the mint returns; and to show that the production of good bullion was not the only point aimed at, I may mention that all the solution, including washes, was precipitated together, the effluent never carrying more than a trace of silver. The displacement of dissolved silver during filtration was practically perfect, from which may be inferred the use of a normal amount of wash; and the bullion produced was neither refined nor even remelted. By an intelligent care of the zinc-boxes once every three days there was no accumulation of short-zinc and at clean-up times all excess zinc was returned to the boxes. No acid treatment of the precipitate was necessary, the filter-pressed product being briquetted with about 20% of flux, and smelted direct.

Base bullion is due either to the presence of base-metals in the ore, such as copper, or to the inclusion of zinc in the precipitate. Since Pachuca practice is under consideration, it is interesting to note from a published account of the scheme of operations at the Santa Gertrudis that, in the working of the Merrill precipitation process, the greater bulk of the solution is only being partly precipitated, "by which a minimum of zinc-dust will be used in the large, or 4-press circuit, and a higher grade of precipitate obtained." From the above we may infer that the grade of bullion at Pachuca, where the Merrill process is being widely adopted, is adversely affected by complete precipitation; and since a quantity of barren solution is absolutely necessary for wash purposes in either filter or press, it follows that the grade of bullion is not what it might be, and that this is the cause of the high refining cost, which is taken by Mr. Denny as typical.

The Merrill process is an extremely ingenious modification possessing many advantages over the older method of precipitation on shavings, but it is obvious that excess of zinc-dust must be used to ensure perfect precipitation, since, with the slight fluctuation in content of solution from time to time, the exact equivalent amount of zinc to be added could not be arranged by any known method.

Since Mr. Denny has shown his approval, at other times in this Magazine, of both the Merrill process, and the use of the filter-press generally, a criticism of the following suggestions would be appreciated.

(1) The necessary slight excess of zinc to be added, thus ensuring perfect precipitation. Smaller presses to be used and a greater number, and the plant arranged so that the contents of each press, as soon as full of precipitate and zinc, could be washed by the fresh silver-bearing solution on its way to the zinc-feeder vat (in the same way as the wash is applied in an ordinary filter-press), and until no further deposition of precious metal occurred in the press; by which time the excess zinc should have been more or less replaced by silver.

(2) The use of an ordinary hydraulic classifier after agitation of the solution and zinc, by which the heavier silver could be separated to go to the press, and the lighter zinc with excess solution removed, returned to the zinc-feeder vat.

Cyanide operations must be conducted either under great disadvantages or with consummate carelessness in a case where money could be saved by the shipping of treatable concentrate to the smelter.

A. W. ALLEN.

London, December 17, 1911.

## Government Commissions of Inquiry in the Transvaal.

The Editor:

SIR—The attention of the Minister of Mines of the Union of South Africa has been drawn to a paragraph, copy herewith, which appeared in the *The Mining Magazine* Vol. V. No. 4 of October 1911 relative to Government Commissions of Inquiry in the Transvaal and he has requested that your attention should be invited to the inaccuracies contained in the statement in question, inaccuracies which he considers are likely to cause considerable harm.

The Secretary of the Department of Mines writing by direction of the Minister remarks as follows: "In regard to the first sentence of the statement the Minister would be glad to have an explanation as to what is meant, as there is not a particle of truth in the statement as it stands. The Committee which reported on the matter to which reference is made based its calculations of ore reserves entirely on the holdings as shown on the Company's working plan.

"It is possible that a misapprehension has arisen from the fact that a portion of the area worked by the Midas Deep was held under mijnpacht title, which, as you are aware, was technically not 'proclaimed' land within the meaning of the Gold Law.

"With regard to the second paragraph of the extract the Government Commission was withdrawn in the case of the East Rand Proprietary Mines on the shareholders of that Company requesting the appointment of examiners under the Company Act. The persons who had been nominated to the Commission were re-appointed without alteration as examiners under the Company Act.

"With regard to the third paragraph of the extract, the statement is entirely misleading and incorrect. The persons appointed by the Government to inquire into the East Rand Proprietary Mines matter consisted of two highly placed Government officials and a prominent resident in Johannesburg, and the constitution of this Committee of Investigation commanded the general confidence of the public."

The High Commissioner would feel obliged if you would be good enough to let him have a reply to this letter.

T. S. NIGHTINGALE,
Secretary.

London, January 2.

[The foregoing letter was acknowledged, and received reply, in our last issue, in a paragraph having equal prominence with the original criticism. This, however, was deemed insufficient and we were asked to be good enough to publish the remarks of the Secretary of Mines in full. Being willing to give space at all times to rejoinders, we acquiesce. The offending paragraph appeared on page 251 of our October issue and the reply will be found on page 12 of our January issue. We repeat that the "unproclaimed area" mentioned by us was probably the ground held under mijnpacht title. Our information came from a mining engineer of high repute. The original commission, as stated in dispatches from Johannesburg, included Mr. J. G. Lawn, consulting engineer to Barnato Bros., and Mr. P. Ross Frames, managing director of the Premier Diamond Mining Company, with Mr. R. N. Kotze, the Government Mining Engineer. We do not accept the description of the third paragraph as "entirely misleading and incorrect." The Secretary of Mines is entitled to his opinion, and we to ours. We are glad to correct errors of fact, if any, but we do not revise opinions on the dictum of anyone, unless that opinion is backed by logical demonstration. We are of opinion, as we stated in October, that "at the present time so many of the mining magnates are in politics in South Africa that it would be difficult to select a commission that would command general confidence." The commission finally chosen did good work and deserved to command confidence, but it was not selected without difficulty; another reliable commission to probe another scandal involving members of the South African parliament could likewise not be selected without difficulty.—EDITOR].

## Basic Lining.

The Editor:

Sir—Referring to your editorial on 'Basic Lining for Converters' in your December issue, I venture to suggest that some of the technical statements require further explanation.

The increase in the size of converters is not, I believe, of such great importance as wholly to explain the success of basic-lined converting, especially as you refer to the work done by W. A. Heywood at Butte, although it may apply to the early work of the Parrott and old Anaconda plants, as there was an interval of several years between these two sets of experiments. My own view is that the improvements in the design and construction of converters generally is the

factor that has made it a success, and this was thoroughly realized and applied by Peirce and Smith in the converter made by them, now in use. I think the large size of the converter has very little to do with the success of the process, having regard to the 96 by 150 in. acid-lined converter used in modern plants for six or seven years past and at the present time. I do not mean to say that in plants producing large amounts of copper that the 25 by 10 ft. basic-lined converter is not more economical than the old 8 by 12½ ft. acid-lined converter. There are, however, comparatively few plants that have matte in sufficient quantity to warrant the use of this extreme size of converter economically, and I desire to point out that a converter half the size of the large acid-lined converter will work successfully and economically as a basic-lined converter.

The main difficulties in operating a basic-lined converter are the grade of the matte and the regulation of the temperature. In the case of low-grade matte (15 to 25%) I have found exactly the same difficulties as C. B. Lakenan mentions in the *Mining & Scientific Press* of October 7, 1911, in which he states:

> "In the management of converters it is found that basic linings cannot stand excessively high temperatures so well as acid linings; neither can they stand the same range of temperatures without serious deterioration. This is a very important point in the successful use of basic linings."

Having been in charge of the metallurgical work of the Steptoe plant, I know the grade of the matte charged to the converters at that plant; it is approximately 50 to 55%, and, as before stated, I have had experience with matte of 15% and found exactly the same difficulties as Mr. Lakenan did with the 50 to 55%, hence it is obvious that the inherent failing of basic lining is the regulation of the temperature. The grade of the matte, of course, has a great deal to do with this point, and I would suggest therefore that the term 'low-grade matte' should be used very carefully, as it may lead to serious errors of judgment in recommendations for the installation of converter plants. The term 'low-grade matte' twenty years ago would have been interpreted to mean between 50 and 55% copper. Ten years ago, or less, 30% matte would have been considered low-grade, and, at the present time it might be interpreted as 15 to 25%. These statements, however, must all be taken when used in relation to converter work.

From my own observation, I should say that a matte below 25% copper should not be put into a basic-lined converter, as the heat-developing reactions are too violent to allow of the conversion of such a grade economically. The degree of temperature formed in the conversion of matte depends on the quantity of oxygen delivered to the bath of matte, the iron oxidized, and the slag formed in a given time. The oxygen unites with the iron which in turn combines with the silica floating on the surface of the charge thus forming a silicate, or slag.

Since, in the analysis of matte, the sulphur remains practically constant, the difference must then be in the iron and copper. As the percentage of copper goes down, the percentage of iron goes up, and the reverse; therefore, the most practical method of regulating the temperature must be by means of the oxygen of the air admitted through the tuyeres; in the case of low-grade matte (15% to 25%) to accomplish this would materially increase the time occupied for converting and change entirely the production of copper from a converter plant of given size.

Second to the temperature generated by the oxidation of the iron, is the temperature of formation required for the combinations of silica and iron, to form a slag, and I think that a great deal can be done on these lines toward obviating the difficulty of regulating the temperature in basic-lined converters.

At first sight it would appear that the purer the silica in the flux used, the more economical the results, but having had experience with silica analysing 92% $SiO_3$, I am inclined to think that better results can be obtained by using a silicate, and it may be that ore as low as 55 or 60% in silica would give better working results in the converter than at any other stage of the smelting operations. I make this statement with reservation, hoping that someone will come forward and verify the suggestion.

From my own observation I think that metallurgists operating plants should use the figure of 30% copper as being the best matte for ideal converting, even if this cannot be standardized successfully in all plants. However, most plants can make a 30% matte more cheaply than 45 to 50% matte, which at one time was considered essential to acid-lined converting.

W. G. PERKINS.

London, December 20.

## Premature Precipitation.

The Editor:

Sir—In your January issue Mr. D. F. Foster describes the treatment of ten tons of silver-gold ore, "roots, small pieces of decaying wood, and charcoal," resulting in an extraction of about 76% of the valuable contents. One half of an assay-ton of "charcoal and splinters," taken from 5·2 kilograms of the residue, was found to contain an amount equivalent to 0·01 oz. gold, and 2·5 oz. silver per ton. From these results Mr. Foster is led to believe that "if free cyanide with protective alkali is present the chances of re-precipitation are small." I entirely disagree with him in his conclusions. There are localities where charcoal, as a precipitant, is used as a substitute for zinc.

The solution and precipitation of gold and silver, in an agitation-vat, may occur simultaneously; and the statement of decreasing metallic content does not infer the absence of precipitating action because the amount recorded may include precipitated, as well as undissolved, metal. The almost complete disappearance of metallic gold and silver in the residue is the only proof of the absence of premature precipitation without re-solution.

Again, the assay of a precipitant affords no evidence as to the degree of precipitation. Had Mr. Foster agitated his pulp with zinc shavings, in place of the unfortunate mixture supplied by nature, a determination of the gold and silver on the remaining zinc would still have yielded a negative result, if used as an indication of the amount precipitated.

Free cyanide cannot exist in an acid solution and, in the treatment of ores, an excess is obviously necessary because 'total cyanide' may only indicate double salts, with no dissolving power. In the test under discussion the figures given show a drop in total cyanide content, during treatment, from 0·25 to 0·08%. In the 3 : 1 pulp in use this indicates a (potassium) cyanide consumption of 10 lb. per ton of ore, allowance having been made for the amount that would be rendered available by the precipitation of the metals from the solution. A further examination of the figures given shows that, between 36 and 48 hours, a consumption of 1·2 lb. cyanide resulted in the solution of 0·35 oz. silver, an amount subsequently reduced (by premature precipitation?), to 0·20 oz. at 52 hours. During the last 16 hours of agitation the amount of metal dissolved would not have paid for half the cyanide consumed. The description given of the ore affords no clue as to the cause of this excessive consumption, and I can only suppose that the organic matter present was fouling the solution to an extent that would have made its continued use, on a similar mixture, a proceeding fraught with the most undesirable complications.

A. W. Allen.

London, January 20.

## Rhodesian Mining.

The Editor:

Sir—At the risk of being denounced again as an inveterate pessimist I have gone to the trouble of combining a seasonable review of affairs with a timid forecast of likely performances. The subsidized Press indulges in pitiful lamentations over depressed markets and unctuous exhortations to the apathetic investor. He has heard the tune before, has paid for the piper many times over, and the discordant notes of recent meetings have only moved him to stand in fear of Rhodesian finance.

I have reproduced the second, third, and fourth columns in the appended table, from my letter which you kindly published in March last. The figures afford a significant contrast—except in the case of the Lonely mine—to the present position of the market and the present profit-value of the mines. There is also an ominous discrepancy between the average yield per ton obtained during the last six months and the officially computed average grade of the ore reserves. Moreover the profit assured has been dropping in many cases as fast as the price of the shares, with the result that the present percentage of profit assured on the market price of several shares has remained almost stationary. The position therefore shows no striking improvement of intrinsic merits and the market valuation appears still highly inflated.

Apart from the Globe & Phœnix, none of the concerns can approach the standard (laid down by some experts) of showing more than 65% profit in fully developed ore reserves, and even here we miss the collateral security of satisfactory developments in the deepest levels of the mine. The Giant is a lingering patient having lost its legs, and whether the loss will be fatal it may be premature to diagnose. There is also trouble in the lower ground-floors of the Eldorado and it should surprise nobody to see how reluctant the experts are in telling the public what they have now "found out" about 'Bucks' and 'Jumbos.'

Your magazine has dealt with the Shamva in a masterly fashion. It has reviewed the

| Company | Number of Shares now issued | March, 1911 Market-Value: Total Value £ | Price of Share | Profit per Share Estimated | Returns Second Half 1911: Yield Per Ton | Mine Profit Per Ton | Ore Reserve: Tons | Value per Ton | Net Profit Per Ton | Total net Profit Estimated £ | January, 1912 Market-Value: Total Value £ | Price of Share | Profit per Share assured | Percentage of Profit assured | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bucks Reef | 150,000 | 300,000 | 40s. | 4s. | 55s. | 3s. 2d. | 6,800 | 52s. 6d. | 2s. | 680 | 41,250 | 5s. 6d. | 1d. | 1½ | Mine worked at a loss in Nov. and Dec. |
| Eldorado Banket | 300,000 | 1,012,500 | 67s. 6d. | 30s. | 49s. | 27s. 7d. | 197,000 | 67s. 2d. | 26s. | 256,000 | 690,000 | 46s. | 17s. | 37 | Veins disturbed at No. 8 level |
| Gaika | 242,649 | 424,600 | 35s. | 2s. 2d. | 36s. 9d. | 13s. | 18,000 / 30,000 | 63s. | 11s. | 26,400 | 315,443 | 26s. | 2s. 2d. | 7½ | |
| Giant | 262,090 | 1,038,980 | 80s. | 25s. 10d. | 33s. 8d. | 19s. 7d. | 308,146 | 41s. 5d. | 18s. | 277,331 | 602,907 | 46d. | 21s. 2d. | 46 | Lode lost below No. 7 level |
| Globe & Phœnix | 800,000 | 2,040,000 | 51s. | 21s. 9d. | 137s. 10d. | ... | 173,613 | 155s. | 110s. | 954,870 | 1,440,000 | 36d. | 23s. 10d. | 66 | |
| Jumbo | 350,000 | 183,750 | 10s. 6d. | 1s. | 32s. 4d. | 6s. 3d. | 17,256 | 41s. | 4s. | 3,457 | 43,750 | 2s. 6d. | 2d. | 8 | |
| Lonely Reef | 271,000 | 813,000 | 60s. | 13s. 4d. | 85s. 4d. | 48s. 6d. | 127,161 | 95s. | 50s. | 317,802 | 785,900 | 58s. | 23s. 5d. | 40 | Mine looking well |
| New Found Out | 177,100 | 193,600 | 22s. | 3s. 6d. | ... | ... | 43,161 | 51s. 6d. | 10s. | 21,580 | 66,413 | 7s. 6d. | 2s. 6d. | 33 | No plant selected to treat refractory ore |
| Selukwe Columbia | 500,000 | 385,000 | 17s. 6d. | 1s. 3d. | 42s. 11d. | 6s. 6d. | 40,000 | 54s. 6d. | 5s. | 10,000 | 125,000 | 5s. | 5d. | 8 | |
| Shamva | 500,000 | 2,187,500 | 87s. 6d. | 21s. | ... | ... | 1,808,000 | 19s. 6d. | 8s. | 723,200 | 1,875,000 | 75s. | 28s. 10d. | 38½ | Two years required to build railway and start large plant |
| Surprise | 249,742 | ... | ... | ... | 15s. 6d. | ... | ... | ... | ... | ... | 124,871 | 10s. | ... | ... | Little hope of finding the vein |
| Thistle Etna | 65,000 | 84,500 | 26s. | 3s. | 33s. 10d. | 6s 2d. | 49,242 | 26s. 4d. | 5s. | 12,310 | 35,750 | 11s. | 3s. 9d. | 34 | |

prospects of a healthy newcomer like the Cam & Motor, of a weakling like the Eileen Alannah, of comet-like stars returning twice in two years, like the Planet-Arcturus, and of many others. Of the 60 finance, holding, and development companies it has criticized two of the most prominent. These two are typical of the numerous share-factories that trade in the products of the Rhodesian veldt. By their material and architecture, by their operations and administration, and by the quality of the goods they put on the market and sell to the public, one may be able to judge the constitution and worth of the other rivals. So I pray for a little indulgence and some more space.

The Amalgamated Properties of Rhodesia with 2,826,374 shares in issue can boast of the following assets: (1) The Champion & Ceylon mines. (2) 4127 mining claims. (3) 1,544,000 acres of farm-land. The mines show "results of very encouraging nature," but no ore reserve worth publishing. Of the 4127 claims 1100 have already been abandoned as worthless. If ultimately an expenditure of £200 per claim is decided upon, even on a tenth of the original area, £100,000 will have to be provided out of the pockets of the shareholders. The *African World*, writing about a "land boom for the seventieth time suggested" admonishes "pedlars of shares" how "vital it is always to remember that agriculturally only about 5 acres per hundred are of account." So much for the Amalgamated Properties assets, unless somebody cares to add to these the potential proceeds from two or three impending law-suits.

The Rhodesian Exploration and Development Company is built of similar material and stands on such pillars as the Eldorado, Gaika, Shamva, Thistle-Etna, and two dozen others of older and newer creation. But the full strength of two such pillars only has been revealed by the directors: the Antelope mine and the Selukwe Columbia. The Antelope share-holding is to be taken over by the absorbing Goldfields of Rhodesia Development Co. on the expert's basis of valuation, namely, £300,000, against a market valuation of £120,000 and an actual ore-profit of £30,000 (60,000 tons worth 10 dwt. or 10s. net). The Selukwe Columbia assets were appraised on the basis of £250,000, against a market valuation of £100,000 and intrinsic ore-profit of £10,000. By inference and comparison shareholders may be clever enough to guess the quality of the other securities of the combine.

Shareholders of some finance companies have probably done wisely in not acting on

your suggestion of calling upon the Board of Trade to intervene. Those that have seen the cracks and rents in the walls will have time to clear out quietly and unobtrusively, leaving some of the treasure behind in the buildings under reconstruction. An examination by the Board of Trade might have caused a panic and a rush, and in the ensuing scramble the whole edifice might have come down with a crash, such as happened in the London & Globe case.

At last the Chartered Company has taken the right steps to exploit its mineral resources on its own account, and the anger of those who have been muddling affairs in the last two decades is out of place. The material is there in abundance, the task has been placed in good hands with Messrs. Bayliss, McDermott, and Maguire at the head. Here is a chance for both the prospector and the investing public.

THEODORE RUBISCHUM.

London, February 1.

**Mine Regulations in South Africa.**—The new Mines Regulation Act, embodied under Act No. 12 of 1911 to consolidate and amend the laws in force in the Union of South Africa, relating to the operation of mines, works, and machinery and to certificates of competence, came into force on December 1, 1911. The old laws of the Provinces of Natal, Cape Colony, Transvaal, and Orange Free State are either wholly or in part repealed, and replaced by this new Act of the Union. The new act is divided into four parts: (1) relating to mines and works; (2) relating to machinery; (3) relating to accidents, ambulance, appeals, summoning of witnesses, etc.; and (4) relating to the certificates regulations.

It will be of interest to mention a few of the most important points in which the new act differs from the old act in force until December in the Transvaal. With regard to the restrictions as to work on Sundays, Christmas Day, and Good Friday, an important clause has been added, relating to the running of stamp-mills or other machinery used for crushing ore, which in future can only be run on the days mentioned, provided that the mills or crushing machinery were erected before the commencement of this act. Following the lead of England, the act introduces the 8-hours system in the following terms: "No person employed to perform underground work in any mine shall work, and no person shall cause or permit any person so employed to work underground for a longer period than eight hours during any consecutive seven days exclusive of the time occupied in going to or from the working place." In certain cases these provisions do not apply. It is to be hoped that the effect of the 8-hours day will not be to raise the accident death-rate as it has done in England. It is highly probable that the accident death-rate will increase, as the rush and hurry of the day's work underground will certainly be increased. Generally speaking, in the past, the mines have been running a 9-hours working shift, for five days out of the six, with a somewhat shorter shift on Saturdays, making a total of about 51 hours, working time, during any consecutive seven days. Under the heading of ventilation the new act sets a standard of quality for mine air. This standard provides for a limited amount of the various gases found in mines. Samples of air taken under normal conditions, not less than one hour after blasting must not contain more than 20 volumes of carbon dioxide per 10,000 volumes of air, except in special cases, where there may be geological sources of production of carbon dioxide. The proportion of carbon monoxide must not exceed 1 volume per 10,000 volumes of air and no detectable traces of the oxides of nitrogen are allowed. Chemical determinations of the quantity of carbon dioxide in the air must be made not less than once in 3 months and a report kept of the same, in a record book, at the mine office. The new regulations make a water-spray or some other suitable method for laying and removing dust imperative. The section of the regulations relating to coal mines is, generally speaking, on the lines of the Coal Mines Regulation Act, as framed by the English Parliament. With the introduction of an increasingly large number of electrical appliances and electrically operated machinery, the position of the electrical engineer on the mines, has gradually become a more important one, and under the new regulations, provision is made for granting electrical engineers certificates of competency and so placing them on the same footing as the mechanical engineers, who in the past have been holding the positions of resident engineers on the mines, to the exclusion of the electrical engineers. Altogether the new act contains an immense collection of regulations, and each mine manager should certainly have a legal adviser who has made a special study of the regulations. It seems almost impossible under practical conditions to comply with the strict letter of the law, and indeed in many quarters the multitudinous details are considered to savour of over-legislation.

# PERSONAL

ROBERT ALLAN is temporarily in charge of the Lonely Reef mine, in Rhodesia.

C. E. BLACKETT, metallurgist at the Golden Horse-Shoe mine, left for Kalgoorlie on February 1.

W. A. BONE has been appointed professor of fuel and refractory materials in the Imperial College of Technology.

H. Y. L. BROWN has retired from the position of Government Geologist to South Australia after 29 years continuous service.

GELASIO CAETANI has joined ALBERT BURCH and OSCAR H. HERSHEY as a firm of mining engineers at San Francisco.

A. O. CAUTLEY has gone to Siam.

FREDERICK G. CLAPP, of Pittsburg, is making investigations in the oilfields of Louisiana and Oklahoma.

GEORGE E. COLLINS, of Denver, was in London for a few days at the end of January.

HENRY CRIBB has been appointed manager of the Tominil mine, in Mexico.

T. W. TEAGUE CURNOE has returned from Colombia to Newquay, Cornwall.

T. DRAPER has left London for Mexico.

HERBERT A. EVANS has left for Peru in the employ of the London & Pacific Petroleum Company.

GEORGE H. GARREY, recently appointed mining geologist to the American Smelting & Refining and associated companies, is in Mexico.

GEORGE A. GUESS has been appointed to the new professorship of metallurgy in the University of Toronto.

J. L. HOLMAN left for Johannesburg on February 10.

C. BARING HORWOOD is making a geological investigation in the Transvaal.

C. E. HUTTON, lately manager of the Van Ryn, has been appointed an inspector of mines in the Transvaal.

J. M. ILES has become manager for the Rayfield Syndicate in Northern Nigeria.

ALFRED JAMES sailed for Johannesburg on February 3, and will be absent three months.

ALVIN R. KENNER is now mine manager for the Rio Plata Mining Co., in Chihuahua, Mexico. D. W. SHANKS is general manager.

NEWTON B. KNOX was in Italy recently.

C. W. LEE, recently at Cobalt, is at Dewsbury, Yorkshire.

W. S. LECKY was in London for a few days, from Toronto.

THOS. H. LEGGETT came over from New York for a few days.

STEPHEN J. LETT is returning to London after being in Sumatra for three years.

ERNEST LEVY is here from Rossland, B.C.

ARNOLD MILNE has succeeded H. Ross Skinner as manager of the Durban Roodepoort mine.

F. H. MINARD is inspecting mines in Arizona and Mexico.

JAMES MORRIS, recently manager of the City Deep mine, is in London.

C. H. MUNRO sailed for New York on January 31, on his return from Siberia.

P. N. NISSEN will return to London from the Rand in March.

F. P. PAUL has returned to Sydney from New Mexico.

WALTER G. PERKINS started on February 9 for Buenos Aires, on his way to the Famatina mine, in the Argentine.

H. A. PIPER left for Rhodesia on January 20.

A. W. PRIOR has resigned as resident manager of the Rio Plata Mining Co. and is now at Los Angeles, California.

A. L. QUENEAU sailed for New York on January 31.

GEORGE M. RICHARDS, recently in Alaska, is taking a supplementary course at the Royal School of Mines.

JOHN SAXTON left London on January 25 for Wolfram Camp, in northern Queensland.

A. MERVYN SMITH is home from India.

A. T. SPEARMAN has left London to join the staff of the Palmarejo and Mexican Goldfields.

L. STUTTERD has been appointed manager for the Montana Tin Syndicate, Tasmania.

A. TELLAM, representing EMIL DEISTER, is in London.

M. O. TILLARD has been appointed manager of the City Deep in succession to James Morris.

H. A. TITCOMB has been making an examination of the Esperanza mine, at El Oro.

H. W. TURNER left for San Francisco on January 20. He will return to London in March.

L. K. WARD has been appointed Government Geologist for South Australia, with R. Lockhart Jack as assistant.

OSCAR B. WARD has been appointed manager of Broken Hill Block 10 mine.

S. S. WEBB-BOWEN is now in Northern Nigeria.

H. E. WEST is now with Charles Butters & Co. in London.

ERNEST WILLIAMS has returned from Porcupine.

# AN INDUSTRIAL CRISIS IN AUSTRALIA

By OUR MELBOURNE CORRESPONDENT.

THE year 1911 ended with a decision in the Federal Court that must make history for Australia. This is the finding of Mr. Justice Isaacs in the matter of the charge preferred by the Federal Government against the members of the Newcastle (New South Wales) coal vendors and the members of the Australasian Shipowners' Association of acting in restraint of trade to the detriment of public interest. From this statement it will be seen that the mining industry is deeply concerned in the decision, for despite the importance of all other branches of mining, the coal industry is gradually assuring to itself pre-eminence. The possibility of such a development was not overlooked by shrewd business men. Consequently there came a steady and extensive acquisition of coal-bearing lands from the Crown in both the mother state of New South Wales and in Queensland. Correlated to coal mining is the coastal shipping interest. This is represented by a group of companies, owning a fine class of vessels. The headquarters of these shipping companies are distributed throughout the states—some in Sydney, some in Melbourne, and others in Adelaide and Brisbane.

These concerns, in the first instance, were purely shipping businesses. They plied for passenger trade and for the carriage of goods, and were dependent for their profits on earnings derived from these sources. In the same way the coal owners (both company and private owner) relied for their income upon the profits derived from the sale of their large and small coal. One or two of them owned an odd collier, but as time went on they abandoned the carriage of their own coal. This meant bringing the coastal shipping companies into closer relationship with the coal-mining industry. Prescience was not required to see that by linking up the ownership of coal mines with the ownership of steamships, a command of the Australasian coal trade would ensue. Not only that, shipping interests would be given a backing of interests which would relieve it from dependence on the ordinary passenger and cargo business. The next step was the semi-fusion of the shipping companies, in fact, if not in name. "An honourable understanding" was arrived at, by which the companies agreed to cut up the business of Australasia into respective spheres of action; they fixed rebates, and gradually in that way apportioned out to themselves practically the whole of the coastal and coal trade

Concurrently there came a stealthy and highly successful incursion into the coal-mining industry. Shipping companies began to buy into coal mines or to acquire properties for themselves. Then, having got their coal placed on the list of accepted fuels by the State railway departments or other great users, they began to work the coal trade to the advantage of their own collieries. For instance, a private member of the coal vendors might tender for coal, but a steamship company's tender would be preferred because "it would be able to guarantee delivery." With the trade thus hobbled the mine-owner pure and simple could not afford to cut prices, for if he did, he would find that he would lose even the last shred of trade owing to the lack of transport. Thus it will be perceived that a combination was evolved which was one of the most powerful known in the British dominions, though it has its parallel in the anthracite trust in the United States.

Mixed up with all this was labour. The Newcastle coal-miner is the most aggressive and the most unruly of all the trades folk in Australia. He has easy working conditions, as mining goes, and he received such a wage, even when the price of coal happens to be far below its present figure of 11s. per ton at the pit's mouth, that he need not work more than three or four days a week to earn sufficient for his wants. He is especially of the sporting amusement-loving type of Australian. No ties bind him and he will throw down his tools at a moment's notice to back up a pack of boy-wheelers who may have struck work because one of their number has been dismissed for some grave breach of duty.

With increased spending tendencies the miner has insisted on receiving higher wages. In that way the selling price of coal at the pit's mouth has been moved up from 7s. per ton to 11s. per ton. For every increase of 4d. per ton in the hewing rate, the colliery owner puts up the price to the public 1s. per ton. While the men make 4d. additional, he takes 8d., all of which is to come out of the pocket of the general user. With competition

such advances in wages and in prices would not be possible, but with combination the thing is simplicity itself. Hence we hear a Labour Minister, like Attorney-General Hughes, declare that while he preferred to nationalize industry, yet, failing that, he looks with a kindly eye on trusts, for with them the earner can force a high wage for himself.

The foregoing statement indicates how (1) the steamship-owners have combined and used their combination to gain a foothold in the coal trade, (2) how the coal-owners have used the claim of the miner for a higher wage, to add to the price of fuel to the consumer. It, however, does not disclose that the steamship-owners, when ordered by the Federal Arbitration Court to pay more to their crews and officers, have put up fares above the amount of the added cost of labour. That also has been done. The sight therefore is presented of the general public being mulcted as to cost of transport and as to the price of fuel by the owners of the two great utilities—coal and shipping.

The decision of Mr. Justice Isaacs now introduces a line of cleavage, for he finds that the dual combination—the Coal Vend of Newcastle and its ally—or rather its parasite—the Steamship Owners' Association are breaking the Federal law that aims at controlling trusts. In other words, that the people have been fleeced by these two combines. Mr. Justice Isaacs took three days to deliver his judgment.

The decision in the present case appeals to every consumer of coal and to every user of the steamship services. The conservative Press, *The Argus*, for instance, while throwing part of the blame for the result upon the persistent demand of the miners and the seamen for wages, is constrained to admit that the line of public interest has been cut by the combination between the two interests. But *The Age* does not mince matters. Of course, it is the personal friend of Mr. Justice Isaacs, having been his sponsor for years in the political world, due perhaps to the fact that he and its editor are of the same nationality. Still it represents the vigorous Liberalism of the people as midway between the Conservatism of *The Argus* and the Socialism of labour. It claims that Mr. Justice Isaacs' judgment "initiates a new era in our national life, as for the first time in the history of Australia the right of the people to a voice in the control of enterprises which vitally affect their social well-being has been recognized and vindicated in a court of justice." It asserts that the combination of colliery-owners and ship-owners has been "fleecing" the people of four States, and it rejoices that His Honour has inflicted fines on the companies aggregating £20,000, as well as having granted an injunction restraining them from continuing the offence. These conclusions are arrived at because the combination is "selfishly shameless and immoral."

But the more serious point to which public opinion inclines is that such a utility as coal should be nationalized. Mr. Justice Isaacs cited the existence of the Victorian State mine as having safeguarded Victoria against the charges of the combines. He went quite beyond the sphere of his duty in dragging that coalfield into the matter, for he should know that the State coal mine cannot be worked so as to enable it to stand against open competition with coal at any less than the present figure. In other words, with the same rigid conditions imposed on coal obtained from the mine as that imposed on coal supplied from private sources, the State enterprise could not continue to work under present conditions. Therefore should a shilling per ton be knocked off the tender price of Newcastle coal its existence would be imperilled. However, the politician spoke in this part of the judgment. Still it would be astonishing if the next move is not an endeavour to scare the nationalization of the whole or a large portion of the coal areas of the Commonwealth. This must be a State question, but the Labour platform aims at such a development. The temper of the public also has been aroused over the exactions of the shipping and the coal trusts, that it would be no long stride, if we found ourselves in the position of seeing the States restoring to the Crown its hold on the coal industry, or reserving the areas not leased (or sold) from private occupation. Thus, for private gain and rather than face the demands of labour, the shipping and coal trusts have jeopardized their own interests, if not threatened their existence. They may seek to escape the effect of the judgment by forming one large company, but such an act would be so flagrant an evasion of the anti-trust law, that in all probability the company would be compelled to disband. Labour troubles too may now arise, for if, as Mr. Justice Isaacs suggests, a fair selling price of coal is much below the present price, then wages will have to come down, with an inevitable upset in the Newcastle and other coalfields. The situation, instead of being improved by the judgment, is made intensely more difficult.

# ORE TREATMENT AT THE ASSOCIATED MINE, KALGOORLIE

By M. W. VON BERNEWITZ.

WHEN a large mill is erected on any mine before the treatment is thoroughly understood, the subsequent alterations and additions to the plant, made necessary by the erection of improved machinery with a view to a successful and economical process, are expensive, and difficult to fit in the old building, especially when the expenditure must be kept down. This has been the case at the Associated mine since 1900, during which time the plant has been improved four times, until now it may be regarded as the most up-to-date mill on the 'Golden Mile' for treating a sulpho-telluride ore by the roasting and cyanide method.

The ores from the Associated lodes, which are being worked down to 2200 ft., are somewhat schistose in structure, highly silicious, hard, and carry the highest sulphur content on the belt. A general analysis of the ore is as follows:

| | % | | % |
|---|---|---|---|
| Insoluble | 65·10 | Magnesia | 5·51 |
| Iron bisulphide | 11·45 | Calcium oxide | 6·70 |
| Ferric oxide | 4·65 | Alkalies, water, etc. | 5·19 |
| Alumina | 2·40 | | |

The mill, as built in 1899–1900, involved the following process: Gates breakers, Roger rolls, Comet crushers, revolving dryers, Krupp ball-mills, Ropp furnaces, the roasted ore being cooled, damped with cyanide solution, trucked to large steel vats, where it was treated with solution by the percolation method, with results that will be remembered by those who have followed metallurgical development at Kalgoorlie.

Later on, grinding-pans and filter-presses were installed, Wilfley tables being used to catch unroasted pyrite from the furnaces. These roasters, being troublesome, were partly superseded by 14 Merton furnaces, the flue system also being re-arranged. The dryers were rejected, and several alterations made in the crushing department. About 1906, it was decided to remodel the plant generally, as power was being wasted, the machinery was too scattered, and costs were high, so the jack shaft was dispensed with, and the ball-mills driven from the main shaft, which was now fixed on concrete pillars on the ground. Four additional Merton and one Associated furnace were built, and many of the old ones re-built; the last Ropp was torn down; the grinding-pans were lifted from their old awkward position to a fine, high, wood structure; the settlers re-arranged, also the agitators and presses; while belt-conveyors were erected to elevate the residue to a high dump, and the extractor-house entirely re-arranged.

Wishing more tonnage treated and a better roast than could be given by the old type furnaces, an Edwards duplex roaster was erected in 1908, with satisfactory results, and another one in 1910.

Soon after this, the mine began to yield much poorer ore than was expected, and it became a question of cheaper treatment on a large scale. So, about the end of 1910, a final re-organization of the plant was decreed, this being partly made necessary by the installation of a mixed turbo-generator ordered early in the year, and involving the changing of the method of driving all the machinery except the mills.

The skips at the main shaft discharge upon a grizzly, the 2½ in. ore passing direct to a belt, which conveys it to the top of the storage-bins. The large lumps go to a No. 7½, type K, Gates breaker, which crushes to about 3 in. size. This machine is driven by a 12 in. by 8-ply rubber belt, driven by an 85 hp. motor, running at 750 r.p.m. This has a controller, circuit-breaker and fuses. In case of an accident, or any foreign matter dropping into the breaker, the motor can be stopped from the top floor. The machine takes 16 hp. running empty, and about 60 hp. when full of ore. The spider of this breaker is fixed so as to divide the flow of ore right around the crushing head. Herein lies the efficiency and great capacity of the gyratory type of crusher. The spider on this type of breaker will let in large rocks, but is constructed rather on the weak side. The arms encircling the body of the crusher do not go right around, but the ends are drawn together by two large bolts. The spider would be stronger if solid all round. The spindle and crushing head is supported from the spider top, and all adjustment is done there also. Very little oil is necessary for the

head and eccentric. One man, at 10s. per shift, watches the breaker, which works about 15 hours daily. The belt which elevates the broken ore to the top of the mill is made of balata 18 in. wide and 110 ft. long, inclined at 27°. It is driven by a 20 hp. motor, running at 720 r.p.m., and takes 12 hp. when loaded. This belt feeds onto a horizontal belt 18 in. wide and 75 ft. long, from which the storage-bins are filled. It is driven by a 10 hp. motor and takes 5½ hp. loaded. To allow the ore to pass the first bin, the belt makes the usual S turn. One man at 11s. 8d. per shift attends to the oiling of the breaker, greasing the belt idlers, and watching the bins generally. These hold 500 tons each. Breaking and storage cost 6d. per ton. From the storage-bins, the ore is fed by Challenge feeders to two 14 in. belt-conveyors, which elevate it to 4 mill-bins holding 80 tons each. These belts are only used about 2 hours per shift.

Four No. 8 and six No. 5 Krupp ball-mills crush the ore through 30-mesh screens. The former are driven at 21 r.p.m. and are loaded with 4480 lb. balls, using 60 hp. and crushing up to 92 tons each daily; the latter run at 25 r.p.m., loaded with 2240 lb. balls, using 23 hp. and crushing up to 43 tons daily. The small mills are only used when the supply of fine ore is low. The consumption of steel averages 0·55 lb. per ton milled, and the grinding-plates last 130 days. With dry ore, the 4 large mills are almost sufficient to crush enough for the furnaces; but the supply gets low when damp ore comes along, so the small mills are run for a time. The mills are belt-driven from the main shaft, driven by the mill-engine, but motors of 60 hp. size have been ordered to drive the No. 8 mill. There will be paper pinions on the motors, and the mills will be driven by double-reduction gear at 23 r.p.m. This is the first instance of this style of drive. A 4-ft. fan is connected with the mills by suitable piping, to draw the dust and blow it into a double-lined canvas collecting-house. This has a V-shaped bottom, with a gear-driven screw for emptying into the fine-ore elevator, and then up to the fine-ore bin. The fan is driven at 1000 r.p.m. by a 10 hp. motor and absorbs 6 hp. An average of 47% of the ball-mill product will pass a 150-mesh screen. The cost of milling is 2s. per ton.

The ore from the mills drops into screw-conveyors, which take it to 2 belt-and-bucket elevators of 12 in. by 8-ply rubber belt, 49 ft. high, with small steel buckets spaced 6 in. staggered. The elevators travel at 259 ft. per min. and give no trouble in lifting about 175 tons each daily to the fine-ore and storage bins, each holding 175 tons.

By a system of screws, push-conveyors, and screw-feeders, the ore is fed into the roasting-furnaces, namely, 4 Edwards duplex, each driven by a 10 hp. motor, and using an average of 6½ hp. They are all 107 ft. long by 11¾ ft. wide in hearth-area, with a crown that springs 10 in. from the hearth-level, and is 19 in. high at the centre. Each pair of furnaces has its own dust-chamber, and a stack 75 ft. by 6 ft. No. 1, 2, and 4 have a fall of $\frac{5}{16}$ in. per foot, and the rabbles turn at 2·6 r.p.m., while No. 3 has a fall of ¼ in. and turns at 4 r.p.m. The central fire-boxes in the former are 42 and 66 ft. from the feed end, while the latter are 56 and 66 ft., the third fire-box being at the discharge end of all. Each furnace has 52 rabbles, No. 1 and 2 having 40, No. 3 has 32, and No. 4 has 36 water rabbles, the others being solid. All rabbles are fitted with tynes or rakes for rabbling the ore. The water, fed to the rabbles from the storage-tank on a day when the outside temperature is 80° F., is 100° and issues from the rabbles near the fire at 160°, the average temperature being 140°. The hot water from all the furnaces is collected in a wooden tank, and pumped to the cooling storage-tank by a three-throw pump, driven by a 10 hp. motor, using 7 hp. It may be mentioned here that hot water circulating about the plant is highly corrosive, iron pipes being rapidly eaten away; so in our new plant all the water-supply circulates in 3, 4, 5 and 6 in. wood pipe, made at Sydney, N.S.W. This pipe, of course, does not corrode, is easily laid down, and is generally a success. Feed to the furnaces is arranged so that they may get from 80 to 100 tons each daily, this being adjusted by means of cone-pulleys. The furnaces average 85 tons each daily. The ore generally shows red at the sixth rabble from the feeder, gradually becoming hotter at the second fire-box. The fire-box at the discharge end rarely has more than three or four logs in it; the sulphur in the ore after the second fire has sufficient heat to burn itself out before the discharge, which is generally cool. With an ore of high sulphur content, this practice may be followed. If the roasting deteriorates, the practice is to shut off the feed for ¼ hour, stop and start the furnace now and again, and admit an excess of air at the end fire-box. Running slowly is beneficial for correction. The fuel consumption is 11% of the ore roasted. The draft averages 0·5 in. taken by a U tube. One man attends to two furnaces, while on

day-shift a greaser attends to all the bearings, which are only greased once daily. Cost of roasting is 2s. 4d. per ton.

The loss in weight in roasting is about 10%. From time to time, there has been discussion on the loss of gold in telluride ores by roasting. G. M. Roberts, when metallurgist at the Lake View Consols and Great Boulder mines, made several tests and found that there was no loss from volatilization; but, of course, there is a mechanical loss in dusting, amounting to about 0·5% from an Edwards furnace. The dust he found to assay practically the same as the original ore. Opponents of the roasting process argue that there must be fairly large losses from these two causes; but this does not appear to be the case.

The furnace-discharge conveyors feed the main push-conveyors, which carry the roasted ore to 2 hot-ore elevators. These are of the chain-and-bucket type, with adjustable gear at the top for tightening or loosening chains as occasion demands for expansion or contraction. Each elevator has a small fan, which collects the dust from the chute into the bottom, and this is blown into cyclone-arresters. From the elevator, the ore drops into a mixer, which is an old 5 ft. pan, with just a gear-driven spindle having 2 arms attached. In this, the ore is mixed with the circulating solution of 0·03% cyanide, and lead acetate is added at the same time in the proportion of 3 oz. per ton of ore. The main push-conveyors, elevators, mixers, and pans are driven by 25 hp. motors, and each side takes 12 horse-power.

The pulp from the mixers flows down launders to twenty 5 ft. pans driven at 50 r.p.m., by five 40 hp. motors, 4 pans being on each. Each pan takes 5 hp. These are just the ordinary type with 18 dies, and 18 shoes pegged on to the muller-plate, in turn fitted to the yoke by a bridle, permitting free movement. The whole may be raised or lowered by the usual hand-wheel and screw. No. 10 pan is used for mixing lime. A small stream of fresh water is continually flowing in, and lime is added in the proportion of about 1 lb. per ton of ore. An excess is required if the roasting is poor. Mercury is added, and the pans are cleaned-up once in a month. The amalgam, concentrate, etc., are ground in a barrel 4 ft. by 2¼ ft. with several rollers inside, for 12 hours. The barrel is then emptied, the amalgam collected, retorted, and melted as usual. The residue from the barrel 'clean-ups' is collected, and treated separately by agitation with strong cyanide solution. Pan shoes and dies last about four months, and are cast in the company's own foundry. The average grinding may be taken as 84% through 150 mesh. The cost of grinding is 1s. 9d.

*THE ASSOCIATED MILL.*

per ton. Experiments have shown that 90% through 150 mesh gives no better extraction than 80% or less on this low-grade ore, so it is proposed to put finer screens on the mills, to give, say 60% through 150, roast, mix as usual and send direct to the agitators, without grinding, agitate longer than usual, and filter-press. If the wash is satisfactory, this should be satisfactory and eliminate the cost of grinding entirely.

The slime from the pans flows to 32 V-shaped settlers, with an area of 1150 sq. ft., but only about 900 ft. in use. A good deal of fine heavy sand is caught in the front row, so the tops are always open slightly, while the other three rows are run out once an hour. One man at 13s. 4d. per shift attends to the elevators, mixers, pans, and settlers; but, of course, he has no time to help on pan repairs and clean-up. The clear overflow from the settlers passes to the main circulation-tank, which collects all press-washings, etc., and all this solution is pumped to the pan-head tanks for feeding the mixers. A 5 in. centrifugal pump, direct connected to a 25 hp. motor, running at 720 r.p.m., lifts this solution, and takes 12 horse-power.

There are 6 A.Z. agitators 17½ ft. by 6 ft. for the treatment of the slime. These are a great improvement on the ordinary slow type and show a better extraction by about 4%. This is probably due to the speed, namely, 60 r.p.m., the pulp being quickly exposed to the air by the rapid circulation, which is some 3 ft. per second from the periphery to the centre. The propeller consists of 3 large blades, the whole being about 6 ft. across. The spindle attached is gear-driven by a 25 hp. motor, each agitator taking 17 hp. when full. Suitable baffle-plates, suspended in the pulp, aid the agitation. A great deal of the power absorbed depends on the set of the propeller blades. Agitation proceeds for 1½ hours with 0·06% cyanide solution, which holds its strength well. The ordinary type of agitator takes 8 to 12 hours, and 2 to 3 hp. When the roast is poor, the A.Z. shows its good work in aiding the extraction. Cyanide is added in large lumps, which dissolve in a few minutes. With ordinary thick pulp, the vats hold 20 tons each, dry weight. Cyanide consumption averages 1 lb. per ton. Cost of agitation is 1s. 4d. per ton.

Each vat is provided with a valve for discharging into a common 8 in. delivery-pipe, through which the pulp flows to a well 4 by 4 by 6 ft. in the pump-floor. Drainage from all the pumps, vats, etc., goes to this well. A Pearn 3-throw pump, with plungers 12 by 10 in., running at 26 r.p.m. driven by a 40 hp. motor fills the 9 presses, taking 8 min. each, at 60 lb. pressure, using 24 hp. Only 8 presses are used in ordinary working, the ninth being reserved as a clarifier for rich solutions, prior to flowing through the zinc-boxes. This press is generally emptied once or twice daily, after being treated in the ordinary way.

The presses are of the common Dehne type, of 50 cake-frames, and 50 cloth-plates, and hand-tightening gear. They hold 4·5 tons dry weight each. After filling, the slime is washed for ½ hour at 50 to 70 lb. pressure, with 0·03% cyanide. This is done by a Pearn 3-throw pump with plungers 10 by 9 in. driven at 35 r.p.m. by a 20 hp. motor, using 17 hp. After washing, the press charge is dried for a few minutes with air at 60 lb. leaving some 18 to 20% moisture in the cake. Cakes are weighed every day, and from these the tonnage discharged is calculated when the moisture has been determined. Two shifts of 8 hours, with 4 hours between, are worked on the presses; and the labour required for 36 to 40 presses per shift is one solutionist, one press-charger, one pump-man, and 8 press-men.

It is intended shortly to conduct trials on the slime with the vacuum treatment, and if as good a wash as is procured by the presses can be obtained, it would probably pay to install a plant on these lines. The labour in filter-pressing is somewhat heavy, as will be noted.

The rich solutions from these presses is pumped from the main storage-vat to the clarifier-head tanks by a Pearn 3-throw pump with plungers 8 by 9 in. driven by a 10 hp. motor at 43 r.p.m., using 8 hp. Cost of filter-pressing is 1s. 5d. per ton.

The residue from the presses is dumped onto two 18 in. belts, 141 and 168 ft. long, travelling toward a vortex mixer between them. The belts are driven by two 25 hp. motors and take 12 hp. The press-cakes drop into the mixer, the propeller of which is gear-driven at 150 r.p.m. by a 10 hp. motor, using 6 hp. Fresh water, costing 1s. 6d. per 1000 gal., and all the salt water available from the mine, is used. A thick sludge flows into a sump, from which it is taken by a Forwood & Down 3-throw pump, with plungers 9 by 18 in., running at 35 r.p.m., driven by a 20 hp. motor, and using 12 hp. at 25 lb. pressure, and pumped to a settling-pond on the company's property. It is found that it takes about 70 gal. water to wash away one ton of residue

containing 20% moisture. One man attends to the belts and mixers at 11s. 8d. per shift. On the settling pond one man at 11s. 8d. is employed on day-shift only. Disposal of residue costs 4 pence per ton.

The rich solutions from the clarifier flow through 6 zinc-boxes, having 8 cells each. These are dressed three times per week. The clean-up is performed once monthly, the rich zinc and sludge being treated with acid and the poorer returned to the head cells. The final sludge is washed in a lead-lined press, dried and roasted, and fluxed in 2 tilting pots, the resultant bullion being run down in a small refining furnace. The amalgam gold is 932 fine, and cyanide bullion 840 fine. The extraction from the original ore averages 93·8%. Cost of precipitation and clean-up is 3d. per ton. It is intended to try precipitating the rich solutions with zinc-dust at some near date.

The total cost of treatment at the above mill (including supervision and general expense, 7d.), is therefore 10s. 6d. per ton, and just 2s. lower than with the old mill. It may be further reduced when the few remaining details are completed. The mill can treat 10,300 tons monthly.

Attached to the works generally is a foundry, where every iron and brass casting necessary, up to 1 ton weight, is turned out, and the fitting-shop can deal with all the castings, steel work, etc. The final product is extremely creditable to all concerned. These shops are driven by 20-hp. motors.

Credit in the remodelling of the above plant is due to the manager, G. M. Roberts, the engineer, H. Wallace, and metallurgist, P. A. Bull, who could plainly see that it was necessary if any profit were to be made out of the low-grade ore now extracted from the mine. It may appear a complicated process; but it seems to be the right one for the particular ore. If the average roasting is good, then the subsequent cyanide treatment will assuredly give high extraction; at least, this is the experience with this type of plant at Kalgoorlie.

*THE EDWARDS DUPLEX FURNACE.*

**Charcoal Gas-producer** engines of English manufacture have been purchased for a new power plant at the Guadalupe de los Reyes mines in Sinaloa, for many years among the principal producers of the West Coast region of Mexico. For several years the company, which is controlled by Spanish interests, has been paying out an enormous sum annually for wood for the present steam-plant. It is hoped that the economies resulting from the new power-plant will enable the company to again operate at big profit. In former years dividend disbursements reached 1,000,000 pesos annually.

# IN THE MALAY STATES

By W. F. A. THOMAE.

TWENTY years ago. What an age it sounds, and yet how all the life and experiences of the intervening years dwindle when you find yourself again amid old familiar surroundings! Nature has not changed, only human progress and industry have scored lines which mark the flight of the years but cannot obliterate the familiarity of aspect, which is so welcome to the memory.

Singapore had not appeared strange to me, though much of it had been rebuilt in those twenty years: the townhall, the hotels, the cricket club, and whole streets of business houses. A magnificent avenue of trees, forming a perfect green archway, had grown up along the esplanade, replacing the old eucalyptus trees. Between the town and docks big hills had disappeared and swamps had been filled with them; while, connecting them, a broad smooth highway with electric trams had taken the place of the narrow uneven road, bordered by dismal mangrove swamps. But it was only in studying such details that the passage of the years had been evident; taken as a whole, it seemed as familiar as though I had returned after days, instead of years. I still lived at Raffles hotel and tiffined at the club, which had not changed, and where some old familiar faces yet remained to greet me. There was the gathering in the evening of traps and carriages on the esplanade around the cricket club, as of yore. The ladies' tennis club was all unchanged. Tanglin, with its comfortable bungalows in their lovely setting of verdant tropical vegetation, was as beautiful as ever. The quaint little gharries with their diminutive ponies, and the ubiquitous rickshaws, just the same as of old.

And now I was seated in a comfortable railway carriage, steaming out of Tank Road station at 7.47 A.M., across the island to Johore, on my way by rail to Penang. Here was solid evidence to remind me of the passage of time. Twenty years ago there existed only short lines from Klang to Kuala Lumpur and from Port Weld to Taiping, and this trunk line was only the dream of a possibility in the dim and distant future. I return to find it an accomplished fact. Not only is there a direct connection of 472 miles of metre-gauge between Johore and Prai, opposite Penang, with branches to Tronoh, Teluk Anson, Batu Caves, Port Dickson, and Malacca, but another trunk line, branching at Gemas (122 miles from Johore), is already completed as far as Semantan, about 76 miles, and is forging ahead through the jungles of Pahang to the Tembeling river and Kelantan, destined to join the Siamese railways from the north.

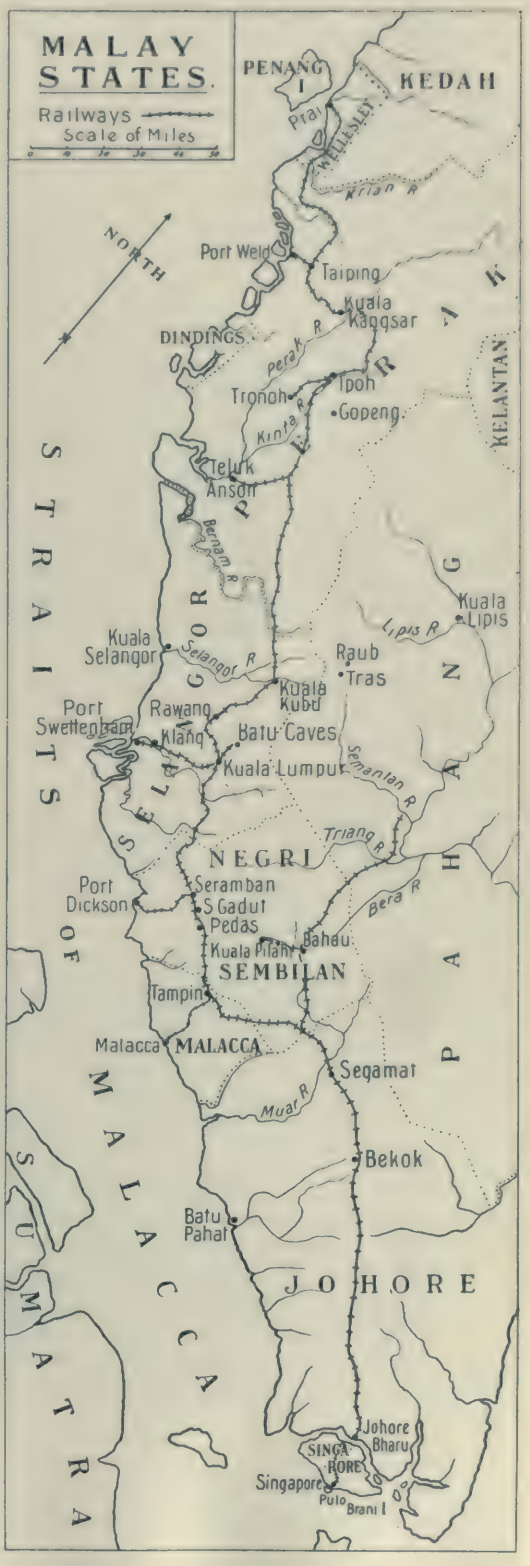
If the building of this railway system had been dependent on a satisfactory answer to the question: "Is there enough traffic to pay?" it would probably never have been undertaken, running as it does through many miles of what was then primeval jungle. Fortunately for the prosperity of the country, the authorities apparently took the larger and more sound view that a railway built through undeveloped land will cause it to be settled and create its own traffic after construction. It was thus ready for the rubber boom when it came, and has made large areas of otherwise inaccessible rich land available for cultivation, to the benefit alike of the country's and the railway's exchequer. Figures taken from the annual report for 1910 of the Federated Malay States railways may be of interest. Railway building in Perak and Selangor was started in 1885. The first 18 years to 1902, when 274 miles were open for traffic, gave a net profit of £988,570. In the following 8 years to the end of 1910, during which the mileage open increased to 538, the net profit was £1,564,294, an average of £195,536 per annum. The last year's profit was £262,000, equal to 4⅓% on the capital expended, £6,000,000. During this last year the working expenses were 60% of the gross earnings; 653,663 tons of freight, 74,799 head of live stock and 9,034,529 passengers were carried. The capital cost works out at about £11,120 per mile, which for a single track, metre gauge, with no exceptional engineering difficulties, is high enough. The slow rate of building was probably regulated by the revenue available. Even with such a high cost, these railways have consistently paid from the start. They are an object lesson in the wise policy of constructing railways even through uninhabited jungle, if the prosperous development of a country is really desired. This fact is impressed on you as from your carriage window you see stretches on both sides of the line, sometimes as far as the eye can reach, in all stages of cultivation

for rubber, the stations being embryo townships, the homes of the large labour population employed in it, whose only connection with their base of supplies and the outside world is the railway. Consider the effect of this on the railway traffic and the revenue of the country.

From the purely artistic viewpoint of the lover of nature, it must be admitted that the change wrought is anything but pleasing. You see large areas where the jungle has just been felled and burnt. Bare and blackened tree-trunks litter the ground criss-cross in all directions, gaunt black and white stumps of all sizes rise disconsolate above the jumble of charred wood and dead vegetation. A scene of destruction and desolation difficult to rival. Then the next stage, where the wreckage has just been cleared sufficiently to give room to the tiny rubber plants, whose weedy little stems look lost in the wilderness about them. There are examples of well managed estates, somewhat older, where the rubbish has been and is being cleared away and no weeds are allowed to grow; but there are also many areas, where apparently further work is neglected, and it is a sad and dispiriting sight to see the long, thin, weedy looking rubber treelets struggling out of a mass of secondary growth and lalang grass. To a layman weeding seems in many cases strangely neglected.

After crossing the Muar river the vast areas of the Johore Rubber Estates exhibit the first examples of rubber plants that have reached the tapping stage. Groves of trees in parallel rows, so close together that no sunlight can filter through the thick canopy of leaves overhead, with the ground between the straight stems cleared of all rubbish and bare of all growth. This is the orderly final result of the desolation first necessitated. And yet even this palls by its monotony. It is a pleasure to pass through stretches of the yet undisturbed virgin forest, with the varied brilliant colours and picturesque diversity of form of its rank vegetation, interlaced with creepers and splashed here and there with gorgeous blooms. Here indeed is artistic beauty with which the drab monotony of the dark green rubber foliage cannot compare. Regret that it is destined to disappear before the march of human progress cannot be stifled.

As we pass Bekok in Johore, I recall the days, just 20 years ago, when I roamed the jungle solitudes here, after worming my way up the Sempang Kiri, from Batu Pahat, as far as Kampong Jimedar, a village of Jakuns, as the jungle dwellers were here called, little



dreaming that I should ever behold what is left of them from a railway carriage.

Near Segamat, Mount Ophir comes into view in the southwest. I greet his majestic cloud-encircled bulk as an old friend, having once spent a night on his summit, 4000 odd feet above the sea, and memories crowd in on me of the arduous climb, the glorious view of a great expanse and a golden sunset in the straits of Malacca, the chill comfortless night and the scramble down at early dawn, enveloped in mist. Passing through Malacca, with its pretty groves of cocoa-nut palms, bordering paddy fields, we cross at Tampin the road from Malacca to Kuala Pilah, recalling many a journey in the past in a pony-trap by day and bullock-cart by night: the latter a mere box on wheels, without springs, the recollection of which makes me hug my present comfort. In Negri Sembilan we pass through some splendid rubber plantations, especially between the stations of Pedas and S. Gadut, miles of rows upon rows of fine trees, each with its little cup for collecting the latex, generally inverted on a stick by its side. Over hill and dale they spread, and you wonder how many miles the collectors have to walk to bring the latex from all parts to the central factory. Again speaking as a layman, it appeared to me that in this advanced stage the trees were crowded too close together.

Late in the evening we arrived at Kuala Lumpur, the capital of the Federated Malay States. What a change in the 20 years! There was then already a railway station, terminus of the short line from Klang, but beyond this only a few primitive bungalows and a native quarter of no extent. Now it is a city rivalling Singapore in appearance, crowded streets, fine Government office-buildings, banks, hotels, electric light, water-supply, and two clubs, the 'Spotted Dog' and the 'Lake,' in beautiful grounds. A large new railway station was nearing completion and active progress in further development was generally evident. I spent a day here renewing my acquaintance with familiar scenes under a new aspect, and the next morning proceeded at 7.45 A.M. by train to Ipoh.

Between Kuala Lumpur and Kuala Kubu I looked in vain for the road along which I had years ago passed in bullock-cart, pony-trap, and on horse-back; at Rawang for the old rest-house, where the wayfarer used to be accommodated in a bare room, while the caretaker was with difficulty induced to supply a tough fowl for his meal. At Kuala Kubu memory recalled a wearying tramp from Kuala Lipis in Pahang, through Raub and Tras, and over the divide past Sanka Dua. I longed to step off and take the motor-car service, which now runs this way daily over a well made road, but could not spare the time. Arriving at Ipoh at 1 P.M. I broke the journey here and visited the Tronoh mine, now the premier tin-producer of the Malay States.

The chief work here is on a gutter between granite and limestone, about 200 feet wide, worked by open-cut. An average depth of about 70 ft. of overburden is removed at an inclusive cost of 42 cents or 1s. per cubic yard. The depth of 'karang' varies up to 100 ft. From a shaft on the granite side the wash is under-cut and unwatered to a depth of 230 ft., the pumping capacity being 3,000,000 gal. per day. The stiff clayey karang is puddled and sluiced, the concentrate being roasted and finally cleaned by hand-washing to a product averaging 72% metallic tin. About 800 cubic yards is treated per day, and about 4000 labourers, mostly Chinese, are employed in 8-hour shifts, working in spells of 4 hours at a time. About 1200 hp. is required for all purposes; this is generated by wood in the dry season and Japanese coal in the wet. The mine is reached by a branch railway from Ipoh in about 50 minutes.

Leaving Ipoh at 1.11 P.M., you reach Prai at 5.43 P.M., whence a steamboat-ferry carries you across to Penang. All the way from Kuala Lumpur the railway passes through rubber plantations and clearings, varied by stretches of jungle yet undisturbed and many wide flats and valleys, in some of which pools of water with irregular mounds of debris indicate old alluvial tin workings, while in others work is still actively progressing. Between Kuala Kangsar and Taiping the railway crosses the hills by steep and winding gradients with three short tunnels, affording most picturesque views of mountainous tropical jungle scenery at its best. Finally we pass through Province Wellesley, a flat little above sea-level, every foot of which appears to be covered with rubber and cocoa-nut plantations, cut into sections by drainage ditches. To all appearances the rubber-trees were as flourishing here as on higher ground.

It had been of absorbing interest to me to frenew an old acquaintance with this most ascinating portion of the tropical East, the history and development of which is an object lesson in empire-building. No small part of its prosperity is due to the wise employment of revenue in railway construction.

*GOVERNMENT BUILDINGS AT KUALA LUMPUR.*

*VIEW FROM THE EMPIRE HOTEL, AT KUALA LUMPUR.*

# PROSPECTING

By JOHN McCOMBIE.

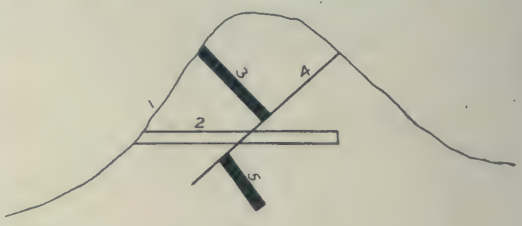
PROSPECTORS, like poets, are born, and you can as easily manufacture a silk purse out of a sow's ear as to make a competent prospector out of an ordinary individual. In proof of this, I have never known an organized prospecting party to make any gold discoveries worth mentioning, because they are invariably made up of men who are not acquainted with the alphabet of the business. All the gold finds of any consequence throughout Australasia have been made by men "out on their own hook," as the saying is, that is, men who could run up a trail of gold as easily as a hound can follow the scent of a herring.

Generally speaking prospectors without any previous experience of mine exploration are prone to driving adits or sinking shafts as soon as they discover a promising orebody on the surface. A good maxim for a prospector's guidance is never to put his head under ground if he can possibly avoid it. Veins outcropping on the surface should be trenched at intervals of, say, 50 feet across their course, and when the position of the richest deposit of ore is determined, sink upon it as far as water and other circumstances will permit. Then the work of sinking a permanent shaft, or that of driving a main adit-level, can be entered upon with some degree of confidence.

The accompanying diagram will serve to show what I mean in this connection: (*1*) represents the surface contour of the hill upon which the outcrop of the vein was located by the prospectors in the first instance; (*2*) indicates the cross-cut that was driven into the hill, and in which the vein never was intersected; (*3*) denotes the dip of the vein beneath the surface; (*4*) refers to the fault that displaced the vein, and threw it down to a point (*5*) below the line of the cross-cut.

Prospectors should never be deterred from exploring a new district because it had been adversely reported upon by so-called mining experts. Prior to development there is no law, written or unwritten, enabling a man to determine either the extent or value of an auriferous deposit. Lodes may have an east and west course or a north and south course, or they may strike through the intermediate points of the compass, and they may or may not carry profitable ore. The profitable ore may be confined to a rib upon either of the walls, or it may be scattered through the lode from side to side, or it may occur in bunches; but all this can only be ascertained by mining operations.

There are lodes in some places where the presence of "good mineral indications" means a fortune; on the other hand, there are lodes in other places where such indications spell failure. There are well defined veins with a westerly dip, and there are equally well defined veins with an easterly underlie. Some believe in the former, while others swear by the latter; but, in my opinion, it is difficult to determine which is the better underlie without examining the banking account of the company that owns the mine. "A splendid class of country" is often hailed as the advance agent of rich gold deposits; but I have again and again seen hundreds of feet of driving done along the line of likely looking veins traversing such country, and nary a colour of gold was discovered therein. On the other




hand, I have examined lodes running through country-rock that was looked upon as being unfavourable to the existence of the precious metals, but carrying rich deposits of both gold and silver, much to the surprise of those who are fond of reasoning by analogy and theorizing on this subject.

Unfortunately, in this mundane sphere we have no students educated in Dame Nature's laboratory; consequently, no one is cognizant of the work carried on therein; and once in proved gold and silver-bearing territory, the only correct theory as to whether the deposits of those metals will be light or heavy is that enunciated by the old digger who said, "where it is, there it be."

The *bonâ fide* prospector should be encouraged and protected by our mining laws to a much greater extent than is the case at present. He should not only have the first right to a given area, say, one hundred acres, all round his gold find, but he should also have the first choice of the nearest machine site as well as water and timber rights, and legal juggling should be debarred from depriving him of such privileges.

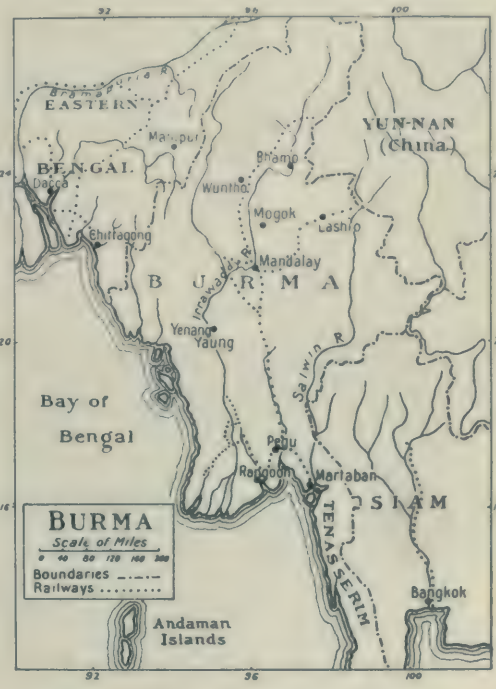
# LABOUR ON THE BURMESE OILFIELDS

By A. M. FINLAYSON.

BLACK, brown, yellow, and white, in that ascending scale of value, are the national pigments displayed by the labourers on the oilfields of Burma, and there are few places where the characteristics of the different races of the Middle East can be studied to greater advantage. At Yenangyaung, as in many of the larger towns of Lower Burma, and along the Irrawaddy generally, the domain of the careless and care-free Burman has been invaded by a host of 'natives' of India, chiefly coolies and small merchants; and it is interesting to note the manner in which each race and *jat* has its own well defined niche of labour.

The Burman still has a monopoly of two or three departments. His natural aptitude for handling the cattle of the country keeps him exclusively employed in bullock-cart transport, which is responsible for the conveyance of timber, drilling tools, engine and workshop details, and cables, from the steamer-landing to the oilfield. His cattle, indeed, are the only domestic animals that receive reasonable care, because the Burman is so dependent on them. Portable boilers and receiving-tanks are hauled by teams of coolies, both Burmese and 'natives' (generally Corringhees) being employed, though generally in separate teams or at opposite sides of the load. Burmans or Burmese are probably faster on the road, as they glory in seeing their load roll quickly if it is on a down grade, or if one of their number trips and runs a chance of being crushed to a pulp. Burmese women and girls commonly form such coolie teams, and work quite as hard as their men-folk. The Burman generally shouts and sings over his work; the 'native' is more leisurely and attempts to coax the tank or boiler along with continual chants and exhortations, the individual muscular effort being insignificant.

The Burman is at all times a casual worker, and this trait is more troublesome in the outlying jungle than on the developed oilfield, where he has been brought under white control. In the jungle, indeed, coolies for steady work are difficult to obtain. Having no conception of work other than on their own plots and paddy-fields, they will come along and agree unblushingly to work continuously on a drilling-well, but after two or three days half of them will go 'back to the land.' They have seen what it was like, satisfied their curiosity, and returned to their wives and their bullocks. In districts where there are no cart-roads, jungle Burmans have to be used as coolies carefully, as there is a continual risk of their stampeding back to their homes after one day's journey, leaving the traveller stranded with all his equipment. The Burman is notoriously thriftless, and a confirmed gambler. He generally toes the line on pay-day, but his money is soon




squandered, and he lives from hand to mouth till the next pay-day. The 'natives' are a strong contrast in this respect.

All 'rig'-builders and rough carpenters are Burmans, and they do satisfactory work. Coolies employed on the drilling — six or seven to each well—are also Burmans. These men have mostly spent a good part of their lives at such work, and are well used to handling the tools and cables, so that the work becomes automatic to them. Thus a driller who is newly arrived on the oilfield, with no knowledge of the language, has little trouble in working with coolies of experience. It goes

without saying that the well-coolies know no language but their own, if we except a few stray expletives, which they learn readily enough from the drillers. The Burmese coolies and carpenters are generally strong, active, and agile, and take kindly to swarming about the rigs, just as they climb their own cocoanut trees and toddy palms. The 'natives' have mostly no stomach for such work. Finally, the men at the bit-dressing forges are generally Burmans. The work requires too much energy for a 'native,' but it needs little skill or care, while the Burman gets sufficient variety and opportunity of amusement out of it.

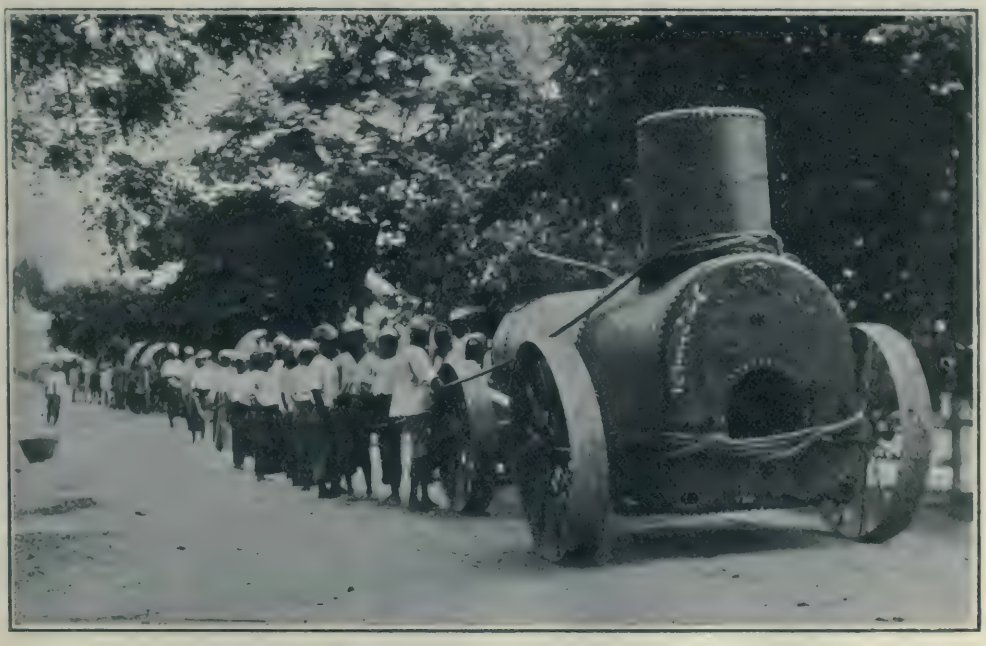
'Natives' shine in different spheres. The lowest *jats* of Hindus, are generally employed as *durwans* in charge of pumping-wells, where they spend a large part of their time asleep on the floor of the rig. This is congenial. Madrassis, Hindustani Hindus, and others find work as boiler-men, for which they require a Government certificate—a valueless piece of parchment, but doubtless sufficient for the purpose. Greasers in charge of engines and pumps include many Corringhees; this work seems to be their forte. Similarly, pick-and-shovel work, such as excavations and earth-works for tanks, is chiefly done by Urias. The best men in workshops and repair-shops, on lathes and the like, are often intelligent Madrassis. These fellows make good mechanics, and it is exceptional to find a Burmese mechanic work with tools, involving as it does some care and attention to detail, which is anathema to the Burman. Chittagonians are employed in various capacities, and more generally in the refineries at Syriam, near Rangoon, as well as on river steamers. They are among the best of labourers, but are apt to quarrel and riot with other classes when they are in force. A Chittagonian mob, perhaps more than any other *jat* of native, has little compunction in rushing at their European officer, if they have, or imagine themselves to have, a grievance. In the matter of *durwans*, an innovation was recently tried in the employment of Punjaubi Mussulmans—old soldiers and reservists—on the wells in place of the low caste Hindus. When the latter were discharged, they immediately responded by burning two rigs belonging to the offending company. The Punjaubis are well disciplined and fairly trustworthy, but their training has not fitted them for work entailing personal responsibility.

In the first place, caste, and in the second place, the peculiar characteristics of the bulk of the 'natives' and of the Burmans respectively, are the causes of the sharp lines of race demarkation drawn through the different branches of labour. Both Burman and 'native' are lazy, in Western eyes, but the Burman is fairly active when on work that suits his hereditary conception of labour, or that gives him the company of his fellows and consequent opportunity for stray diversion. He has no patience or concentration in small matters, and is at all times a rough workman of the slap-dash order. Coolies, on the other hand, while physically and temperamentally unfit for bursts of hard work, have the patience of mules, if given their own time. This last proviso is a *sine qua non*, both with the black and brown races. The 'native' and the Burman are alike adept sleepers. The former prefers the floor of a rig, while the Burman sleeps through the heat of the day with ease whether seated astride a 10-inch pipe, lashed to a bullock-cart, or curled up in a rig-builder's tool-box.

Domestic servants comprise both 'natives' and Burmans. A Madrassi cook is always a better *chef* and a bigger scoundrel than a Burman cook (if the latter can be found); while the 'native' is generally, but not necessarily, a more satisfactory 'boy' than the Burman. The Burman as *syce*, that is, groom, is generally a failure. He is, on general principles, fond of his animals, but cannot see the necessity for grooming a pony, because his forbears never did it. Zerbaddis—half-castes born of Mahommedan fathers and Burmese mothers—are a shiftless class, generally dishonest and seldom reliable. In them the vices of both parents seem to be magnified and the virtues dwarfed. They are not prominent on the oilfields in any capacity.

Office-clerks are chiefly educated Burmans, but include also 'natives' and Eurasians. They all vary in efficiency, but the Burman is probably the most reliable. He is generally capable and smart. In competition with all these, however, the Chinaman comes out on top. Chinese in the position of head-clerks or cashiers are generally a conspicuous success, owing to their honesty, thoroughness, and capacity for hard work. Otherwise, Chinese, chiefly Fokeinese (from Amoy) and Cantonese, are not prominent on the oilfields. There are a few Chinese carpenters, who draw bigger wages and do vastly better work than the Burmese. The latter cannot understand why a bungalow should be built with any more care than a derrick. The Chinese storekeeper, similarly, may always be expected to oust the

*PORTION OF THE TWINGON RESERVE, YENANGYAUNG OILFIELD.*



*BULLOCK-CARTS AND BURMESE COOLIES HAULING A BOILER.*

Burman competitor, and so it is at Yenangyaung. Chinese coolies are absent from this district.

Labour troubles are rarely serious. A section of coolies may occasionally strike for higher wages, if they know they cannot be replaced. When the demand is not exorbitant, a rise is generally granted and the strike ends as soon as the news is circulated. Drunkenness is not a source of much trouble, and assaults and dacoities are rare. The usual coolie wage is 8 annas per day, or 15 to 16 rupees per month. This is also the average pay of *durwans* and boiler attendants. A well-driller's coolies get from 15 to 25 rupees per month, and rig-builders and carpenters from 20 to 40 rupees. Office clerks receive from 50 to 120 rupees.

The drillers, of whom there are about 150, constitute a highly-paid class of skilled mechanics. They sign under a three years' agreement—which is frequently renewed—and receive the equivalent of 600 rupees per month, or £480 per annum. In the early days, the Canadian pole-tool system was given a trial, but this was soon supplanted by the cable system with standard rig, which has held its place ever since. The drillers have come nearly all from the mid-continental fields of Pennsylvania and Ohio, and some from the Gulf of Mexico. A few Canadians are still employed with the Canadian plant, chiefly on test-wells ; and some Californians have lately arrived.

The system of drilling is, of course, different from that to which the men have been accustomed. Instead of two drillers doing all the work, one man drills the well, the heavy work of handling tools and casing being done by teams of Burmese coolies. This gives the driller plenty of opportunity for sitting down, of which, needless to say, he takes full advantage, especially the man who protests most vehemently about his love of 'hustling.' The drillers vary in efficiency, but the average are good workmen, and get on as well as can be expected with their coolies. Where trouble occurs between a driller and his coolies, it is generally due to the former's ignorance of the language, and to the inability of many white artisans to handle coloured labour with any degree of tact. Thus have arisen one or two unsavoury revolver-shooting incidents in the past.

The Americans are vigorous in their denunciation of the Canadian system ; the Canadians, being in the minority, are less dogmatic. The men from the east of America, again regard the advent of the Californians with little favour, so that there is quite a degree of provincial and professional jealousy among the drillers. Baseball grounds have been laid out in each of the three chief districts, and July 4, which is a close holiday and a time of high revel, is celebrated, among other diversions, by baseball matches. They are keen poker-players and not generally heavy drinkers. Bouts occur chiefly on the Glorious Fourth and on occasions when a driller gets permission to go down to Rangoon to "have his teeth seen to." The driller then becomes unpopular with the captains of the Irrawaddy Flotilla Co., on whose steamers he travels.

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**The World's Coal Production.** — A Board of Trade publication issued last month gives a wealth of statistical information relating to the production, consumption, imports, and exports of coal in all the principal countries of the world during the 25 years from 1886 to 1910, together with reports on the number of men employed in the coal mining industry. The output of the five leading countries for the past two years is given in the following table :

| | 1909 tons | 1910 tons |
|---|---|---|
| United States | 411,432,000 | 447,837,000 |
| United Kingdom | 263,774,000 | 264,774,000 |
| Germany | 146,397,000 | 150,372,000 |
| France | 36,519,000 | 37,254,000 |
| Belgium | 23,140,000 | 23,532,000 |

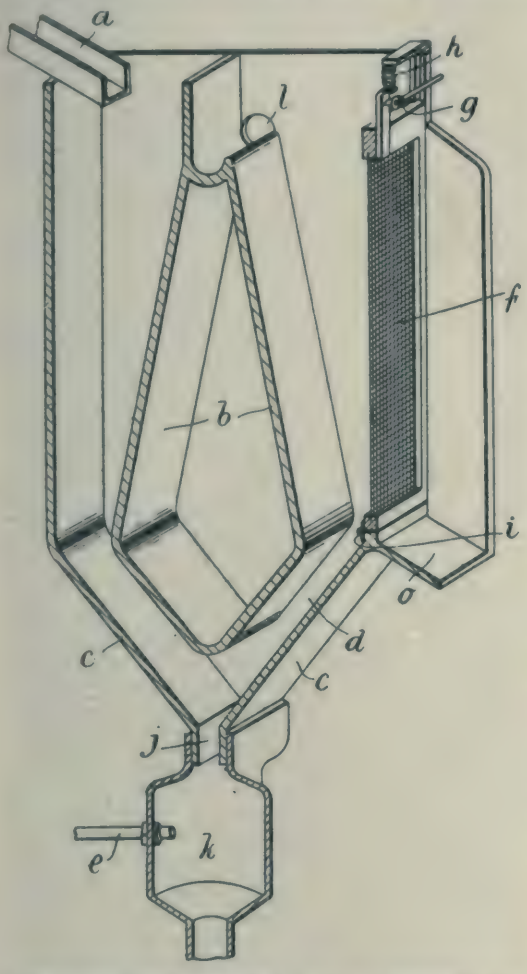
The total reported production throughout the world during 1910 was 1,035,000,000 tons. The value at pit's mouth for 1910 was as follows : United States £131,152,000, United Kingdom £108,378,000, Germany £75,062,000, Belgium £13,955,000 ; the French figures for 1910 are not yet available, but the value for 1909 was £22,749,000. The figures for production during the last two years in the leading British possessions were as follows :

| | 1909 tons | 1910 tons |
|---|---|---|
| India | 11,870,000 | 12,047,000 |
| Canada | 9,376,000 | 11,425,000 |
| Australia | 8,186,000 | 9,759,000 |
| South Africa | 5,534,000 | 6,436,000 |
| New Zealand | 1,911,000 | 2,197,000 |

More persons are employed in the coal-mining industry in the United Kingdom than in any other country. In 1909 the number employed above and below ground in each of the principal producing countries were as follows: United Kingdom 992,300, United States 666,600, Germany 613,200, France 187,200, Belgium 143,000.

# PRÉCIS OF TECHNOLOGY

**The Stanley Classifier and Rand Dumps.**—The *South African Mining Journal* for December 16 contains an article describing the new classifier invented by G. H. Stanley, professor of metallurgy in the South African School of Mines and Technology, and its application to the re-treatment of the tailing-dumps on the Rand. The problem of re-treatment of the accumulated tailing has often been considered, but no serious effort has ever been made to carry the propositions into effect, it being generally supposed that the question could be postponed until a later date when




the mines themselves began to give a decreased output. The new policy of using the tailing as filling for the exhausted stopes has caused those interested in the metallurgical problem to press matters forward, for it is obvious that if the tailing is sent underground again, its gold will be lost for ever. It is clearly recognized that the content of the tailing dumps varies widely, as also does the fineness or coarseness of the constituent particles and the relative amount of pyritic material present. Many people who have contemplated re-treating the dumps have been deterred by the irregularity and the consequent difficulty of separating the material that requires re-grinding. The classifier invented by Mr. Stanley removes this difficulty. It has been tried experimentally at the Robinson mine, under the supervision of W. Laurie Hamilton, and the results have been tested by A. F. Crosse. Mr. Hamilton estimates that there is 70 million tons of sandy tailing, left in the days before the advent of the tube-mill, and that the gold in it amounts to from 1 to 1½ dwt. per ton. The Stanley machine is a combination of a hydraulic classifier and a screen, and is designed to keep the largest sizes together irrespective of their specific gravity. Much of the coarse material is pyritic and settles easily, but the lighter parts are apt to pass over with the fine. In order to prevent this, a screen is interposed, which collects the coarse light particles, and at intervals returns them to the heavy coarse material. By this arrangement the sand of the dumps is separated into three classes: (*1*) concentrate consisting of *plus* 60 material together with the pyrite; (*2*) fine, consisting of *minus* 60 material; and (*3*) slime. Of these three divisions, the concentrate contains from 40 to 65% of the total gold, and the fine 40 to 45%, while the slime is of less importance, being only 3 to 5% of the total weight of dump material. In the trials of the Robinson dump the following figures were obtained:

| | |
|---|---|
| Content of dump ..... | 1·13 dwt. |
| Content of concentrate ..... | 1·55 dwt. |
| Content of fine..... | 0·68 dwt. |
| Content of slime ..... ..... | 1·85 dwt. |

The concentrate was re-ground, and by cyaniding and agitation gave an extraction of 80%. The fine did not require re-grinding, and gave 67% extraction. The slime gave 90% extraction. It is calculated that the average extraction will be 75%, with a minimum of time occupied in the process. The cost of treatment per ton is estimated at 6d. for classification and transport, 7½d. for re-grinding, and 1s. 3d. for cyaniding, being a total over the whole amount treated of 2s. per ton. If the dump material is treated immediately before its delivery for stope-filling purposes, the cost of handling will be reduced. The probability is that a profit of 1s. 6d. per ton can be made on this particular dump, without including the outlay on plant or cost of administration.

In order to illustrate the principle of Mr. Stanley's machine, we reproduce herewith one of the drawings in his British patent specification 25746 of 1910. The pulp is fed at (*a*), and as it passes through the constricted part (*d*) its velocity is increased. The heavier and larger particles fall through the slot (*j*) into the receptacle (*k*), where the hydraulic equilibrium is preserved by a water inlet (*e*). On rising into the space between the partition (*b*) and the screen (*f*), the current once more slackens, and thus the larger particles of low specific gravity that will not pass the screen fall down on the side of the compartment nearest to the screen and are able to make their way to the slot (*j*) without interference with the upward current that is strongest on the side nearest to the partition.

**Stope-Filling.**—*Mines and Minerals* for January contains an interesting contribution to the records relating to stope-filling, giving details of the water-borne method as used in Pennsylvania in 1886. The article refers to Edgar Pam's statement in *The Mining Magazine* for October last to the effect that this particular method now being adopted on the Rand originated in 1901 in Silesia. The evidence brought forward by *Mines and Minerals* clearly shows that Silesia cannot claim priority. We give herewith an outline of the work done in Pennsylvania in 1886. In this year the workings of the Kohinoor anthracite colliery,

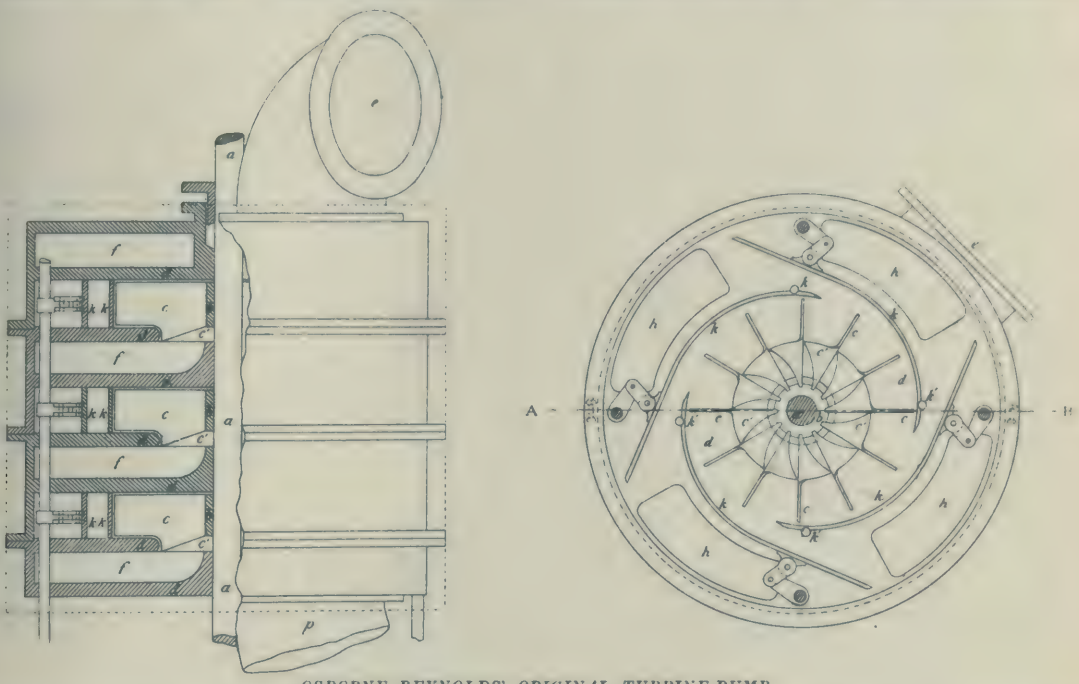
under the western part of the town of Shenandoah, threatened to collapse and to seriously damage the surface and the buildings upon it. The seam was unusually thick at this point; its general thickness was 50 to 60 ft., but owing to an overlap its thickness here was from 100 to 120 ft. The original owners were R. Heckscher & Co., who kept incomplete records of the workings, and it was not until the engineers of the new owners, the Philadelphia & Reading Coal & Iron Co., made new surveys, that it was recognized that the workings were only 400 ft. from the surface. R. C. Luther, the chief engineer, decided to remedy this unsafe condition by flushing culm through bore-holes, and accordingly holes 8 in. diameter were made from the surface to the higher points in the workings. Scraper-lines were constructed for the purpose of bringing the culm from the dumps to the bore-holes, and the necessary water was pumped from the neighbouring creek. The culm was screened at the dumps before delivery to the scrapers, and it was fed into the holes from the scrapers by manual labour. On reaching the workings, the water drained into the sump, and was returned to the surface by pumps. The culm packed solidly, and during the 25 years that have since elapsed there has been no subsidence of the surface.

**Geology of Porcupine.**—The *Quarterly Bulletin* of the Canadian Mining Institute for October contains an article by A. G. Burrows on the geology of Porcupine. This paper is an abstract of the author's official report prepared for the Bureau of Mines of Ontario. We have given prominence on many occasions to opinions on Porcupine, and in particular to an excellent account of its geology by Reginald E. Hore in our issue of April last year. The present paper is a useful addition to those previously published.

The Porcupine area is situated on the Hudson Bay slope of Northern Ontario, about 100 miles northwest of Cobalt, and the elevation averages 1000 ft. above sea level. The country is one of low relief; occasional ranges of hills reach an elevation of 150 ft., but abrupt changes in elevation are less than 50 ft. As a rule rocks outcrop only a few feet above the drift, and are of small areal extent. To the south and west of Porcupine lake the country is rather more elevated and the rock exposures are more frequent. The area is for the most part covered with drift, which consists of stratified clays, sands, and gravels of post-glacial age, and in addition there are patches of moraine material. The rocks may be classed as pre-Cambrian, and the Keewatin predominates in extent, and also in importance from the point of view of containing the larger amount of gold-bearing veins. The gold is associated with quartz that has penetrated, while in solution, the fissures in the Keewatin and Huronian series. The irregular fissuring has produced a great diversity of quartz structures, varying from the tabular or more often irregularly lenticular vein that may extend for several hundred feet, to the smallest possible veinlets only a fraction of an inch in thickness and a few feet in length, ramifying in all directions. The latter variety is typified by the fissuring of ankerite bands that are characteristic of these gold deposits. Irregular lenticular bodies of quartz often occur having a width of 10 to 20 ft. and a length of 50 ft. Also there are dome-shaped masses of quartz, the downward extension of which has not yet been fully ascertained. In some cases these masses may be seen in contact with underlying rocks at a low angle, suggesting that they are broad lenticular masses that have filled lateral fissures in the country rock. The most conspicuous masses of this kind are on the Dome property where the two larger measure 125 by 120 ft. Though gold-bearing veins occur over a wide area and are often isolated, it is more usual for them to be found in groups along certain lines. In these zones of disturbance the country rock is generally schistose. At the Dome mine the disturbed area is 600 ft. wide and contains numerous narrow quartz veins as well as the large irregular quartz masses. Well defined zones of disturbance are found in Tisdale fifth concession, where the rock is chiefly a light, fine-grained, rather massive greenstone. This rock is not much fissured, but here and there through it are bands of rusty-weathering ankerite, that is, carbonate of lime, iron, and magnesium, which is generally schistose. Most of the carbonate is of secondary origin. It is possible that the shattering and fissuring of the greenstone may have caused a deposition from migrating carbonate solutions, partly filling fissures and partly replacing greenstone. These carbonate bands were fissured at a later period, and gold-bearing quartz solutions deposited in them. The irregularity of such veins is well exemplified on the Crown Chartered and Armstrong-McGibbon properties. Where the veins are small it is necessary to mine both the carbonate and the quartz veins. Gold is often found in the carbonate near the contact as well as in the quartz. It has been noted that at many properties the gold is found in the greatest quantity along defined lines which give a streaky character to the ore. On the surface the streaks are rusty owing to the oxidation of the pyrite, and at depth they are dark grey or greenish. Thin sections of quartz show grains of quartz of irregular outline, often containing liquid and gaseous inclusions. That there has been much secondary pressure is indicated by strain shadows, and along lines of slip or fracture planes there has been much crushing of the quartz to finer grains. Secondary minerals such as calcite and sericite are found in these crushed areas, and also iron pyrite in cubic crystals that has evidently been deposited subsequently to the crushing. The fine dark streaks may have resulted from a solidification and shrinkage of the quartz, thus forming filmy cracks; these latter would then become slip or crushing planes, along which the richer gold-bearing solutions penetrated at a later period. These streaks are frequently slickensided. It is difficult to distinguish between the secondary quartz deposited in the cracks from the original quartz, so it is not always possible to say whether the visible gold is in the original or secondary quartz. The ankerite is found associated with practically all the quartz veins in the neighbourhood. It may have been absorbed from the wall-rock, which is frequently dolomite or a rock impregnated with dolomite or calcite. Fragments of country rock are sometimes found in the veins. Occasionally thin veinlets of clear calcite cut through the quartz veins. The distribution of the gold is irregular, mostly occurring along one or both walls, while the remaining portions of the veins are poor. Considering the irregularity of the veins and of their content, the average of the ore mined must be considered low-grade. Most of the ore should be free-milling, and the pyritic material, which is easily removed by concentration, is amenable to cyanide treatment.

**Miner's Phthisis.**—In August last a Royal Commission was appointed by the West Australian Government to inquire into the amount of pulmonary trouble experienced by miners in that province, and to suggest regulations for minimizing the disease and ameliorating the lot of the miner. The commission consisted of R. Logan Jack, R. M. Mitchell, R. A. Varden, R. Hastie, and J. Daw. Their report was issued in De-

cember, and it is published in full in the *West Australian Mining Journal* for December 9. The recommendations are strongly in favour of a strict exclusion from the mines and treatment plant of anyone suffering from tubercular lung trouble. The suggested rules for examination and notification are stringent. Not only so, but it is proposed that at intervals of six months all employees shall be examined for the detection of early symptoms or pneumoconiosis, and that those who exhibit such shall be excluded. The commissioners recommend that a 'Board of Miners Claims' shall be established to deal with the provision of some compensation on the part of the government for those who are in these ways precluded from following their avocation. They also propose that a 'Board of Mining Experiment' shall be formed for the purpose of investigating inventions relating to improvements in methods of ventilation and for the prevention of accidents, and to inquire into the nature and noxious qualities of gases given off by explosives.



*OSBORNE REYNOLDS' ORIGINAL TURBINE-PUMP.*

**Turbine - Pumps.** — At a meeting of the Institution of Mechanical Engineers held on January 19, Edward Hopkinson and Alan E. L. Chorlton read a paper on the evolution of and present development of the turbine pump, especially in connection with the series pump suitable for high lifts. They gave Osborne Reynolds the credit for the origination of the modern idea; and traced its gradual evolution at the works of Mather & Platt, with which firm they are connected. The rotary machine for raising water is an old contrivance, but until thirty years or so ago its application was considered as limited to low pressures and small lifts, because if used against great heads the machine would be necessarily small for the power required, and this would involve high speeds and strong design beyond the limits of practicability. By splitting up the action by using a series of impellers arranged on one shaft, the chief objection to this machine has been removed. Probably John Gwynne was the first to recognize this adaptation of the principle, and his patent of 1851 describes many interesting details in this connection. Another improvement was afterwards effected by the provision of suitable guides which take the water away without shock or whirl. It was Osborne Reynolds, professor of engineering at Owens College, Manchester, who devised in 1875 the turbine-pump that has proved to be the original from which all others have since sprung. His machine was illustrated in Messrs. Hopkinson and Chorlton's paper and we reproduce the drawing here. There are three sets of impellers consisting of radial vanes (*c*), and three water-chambers (*f*). If the machine is working as a turbine, the water enters at the pipe (*e*) and, passing through the orifices (*h*), is directed between the guides (*k*) to the vanes (*c*), which rotate in the same direction as the hands of a clock. If working as a pump, the shaft (*a*) is rotated by power in the opposite direction. It will be seen in the drawings that the guides were adjustable, a design that was afterwards abandoned. In 1887, Mather & Platt made a turbine-pump on these lines for the Owens College laboratory, and in 1893 undertook its commercial manufacture. In 1896 the firm of Sulzer Brothers, of Winterthur, Switzerland, took up the manufacture, and until 1904, there was an agreement between the two firms to interchange ideas and results of experimental work. Since then they have developed the machines independently. A great many modifications in detail have been made for the purpose of minimizing friction and shock. The impeller is now made with shrouded vanes, that is, they are fixed between discs instead of being supported only at their point of attachment to the shaft, and they are no longer made radial, but are bent back. The internal passages and ports are also made in such a way that the flow of water shall be smooth and regular. The mechanical structure of the chamber-casings and of the devices for taking up the end thrust on the shaft have been greatly improved. The authors

described several of the latest type of turbine-pump. One intended for mine drainage will deliver 2500 gal. per min. to a height of 2000 ft., running at 1450 r.p.m. and absorbing 1900 hp. This has seven impellers arranged in series. The efficiency works out at 80%.

**Water-Supply of the Witwatersrand.**—A paper on this subject was read by Donald Calder Leitch before the Institution of Civil Engineers in December. Until 1907, when the great waterworks constructed under the direction of Mr. Leitch were completed, the Rand had no public water-supply, except within the municipality of Johannesburg, and the outside mines and their communities depended for their supply on their own enterprise. Our Johannesburg correspondent gave, in our issue of November last, an idea of the relative amount of water taken at the present time by the mines from their own reservoirs and from the public supply respectively. The capacity of the old Johannesburg supply was 2½ million gallons daily, and Mr. Leitch's work was undertaken with the object of increasing the supply to 10 million gallons daily, and to extend the area of distribution to the whole line of the Rand, from Randfontein on the west to Springs on the east. Most of this district lies along the south slope of the Witwatersrand, and the water obtainable in the quartzites and shales is small. Further down the slope, and overlying the Witwatersrand series, is the diabase of the Klipriversberg, and this is in turn overlain by the dolomite that fills the Klip river valley, and by the Gatsrand beds of shales and quartzites, all of these beds dipping to the south. The dolomite is the only rock that is serviceable for water-supply. The old Johannesburg supply came from the Zuurbekom pumping station toward the head of the valley, situated ten miles to the south of the Roodepoort section of the western Rand. Further down the valley, at Olifantsvlei, the Vierfontein syndicate, formed by the mines, had established another pumping station. This was taken over by the Rand Water Board in 1905 and made the basis for the extended operations. The new pumping station was built at Zwartkopje, still further down the Klip river and situated ten miles directly south of the centre of Johannesburg. Mr. Leitch gives full details of the borings, the pumps, the distribution system, and the various subsidiary reservoirs. The water is pumped first to Turffontein Nek in one lift, an eminence two-thirds of the way toward Johannesburg. This lift is 900 ft. high, a rise unprecedented in connection with water-supply. By the rules of the Institution of Civil Engineers, the reprinting of their papers in any detail is considered a breach of copyright, so we are not able to treat the subject at the length it deserves.

**Nomenclature of Copper Alloys.**—At the January meeting of the Institute of Metals, Walter Rosenhain read a paper calling attention to the unscientific use of names and words in connection with copper alloys, and urging that the Institute should take action with a view of establishing a standard of nomenclature. The chief source of confusion arises out of the terms 'bronze' and 'brass.' These two words have been allowed to travel far away from their original position, and inventors of special alloys are continually adding to the worries of the scientist by misapplying them. Mr. Rosenhain desires that their use should be brought back to the old standard. Bronze should be used to refer to alloys of copper in which tin is the principal added metal, and brass to those in which zinc is the other chief constituent. It is obviously wrong to call an alloy of copper with a relatively small amount of aluminium an 'aluminium bronze,' and a mixture of copper and zinc with less than 1% manganese a 'manganese bronze.' Similar difficulties are found in connection with the copper-zinc-nickel alloys, some of which are known by the misleading name of 'German silver.' Mr. Rosenhain suggests that copper alloys should be divided into four classes of 'binary' alloys, that is, mixtures of two metals of which copper is one, and the other tin, zinc, aluminium, or nickel. These four classes should have distinctive generic names; the first two are already recognized as bronze and brass, and he asks the Institute to invent others for the latter two, preferably monosyllabic. The coining of simple words as against scientific words is not the metier of a dignified society, otherwise we might assist Mr. Rosenhain by suggesting 'brail' and 'brink.' He suggests 'cupro-aluminium and 'cupro-nickel.' For the ternary alloys consisting of characteristic admixtures of other metals to any of these four classes he would use the name of the special metal as a preceding adjective. Thus 'aich metal,' that consists of 60% copper, 38·2% zinc, and 1·8% iron, would be called 'iron-brass,' and brasses with substantial contents of lead would be 'lead brass.' Many metals would present difficulties of classification owing to the third metal being present in large quantities. For instance, so-called 'electrum' is composed of 51·61% copper, 22·58% zinc, and 25·81% nickel. According to the above classification it would be called a 'zinc brink' or 'zinc cupro-nickel,' but it would be more convenient to call it a nickel brass. In determining the best classification of such ternary alloys, the properties and microstructure would of course help. Mr. Rosenhain expresses no objection to the use of fancy names or of inventor's and manufacturer's names, such as muntz metal and naval brass; it is the misleading use of technical terms to which he calls attention.

**Mining Industry of Japan.**—The January *Bulletin* of the American Institute of Mining Engineers contains a comprehensive paper on this subject by Kleijero Nishio. This paper will be accepted as the standard record of the history of mining and metallurgy in Japan. The author divides the history into two portions, namely, from earliest times to 1867 when the present reigning dynasty was restored, and subsequently to this date up to the present day. We have not space to quote the many interesting records in the first portion, and merely remark that copper was the great metal during many ages. Before the restoration in 1867, the mining and metallurgical arts had reached a high state of development, with the use of no power but that of manual labour. Subsequent progress has consisted of the application of steam, water, and electric power and of mechanical contrivances of all sorts. In 1872 a Bureau of Mines was established at Osaka, called at the time the Osaka Copper-Office, and transferred later to Tokyo. For the purpose of introducing methods from abroad, the government acquired some of the larger mines and provided capital and foreign advisers. From 1868 to 1870 the following mines came under government control: The Ikunos silver-copper mine, the Sado gold mine, the Kosaka silver mine, the Takashima and Miike collieries, the Okudzu gold mine, the Kamaishi and Nakakosaka iron mines, the Innai silver mine, and the Ani copper mine. In 1870, Baron von Richtofen, the German geologist, was engaged to direct prospecting work and to form a mining school. Altogether 78 civil and mining engineers and geologists were collected from England, America, France, and Germany, for the purpose of instructing native learners in the occidental arts. As time went on, the government considered that their work in fostering the industry was completed, and they proceeded to hand

most of the above-named mines to private owners, and at the present time they retain control of only two collieries, solely for the benefit of the navy. In 1890 a new law was introduced establishing permanent mining rights. The first mining school was founded in 1870, and in 1887 it was expanded by the inclusion of other engineering subjects. Other courses of lectures on mining were also started in 1877 at the Tokyo College, and in 1886 both were included in the Tokyo

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owners, of every new idea is a matter of common knowledge.

**Microscopical Examination of Coal.**—In our last issue we gave a précis of part of Vivian B. Lewes' paper on the origin of coal. We have since then received a paper by James Lomax read before the Manchester Geological and Mining Society, entitled 'The Microscopical Examination of Coal, and Its Use in Determining the Inflammable Constituents Present Therein.' The results obtained by Mr. Lomax are of unusual interest, and they provide a large amount of information hitherto unavailable relating to the constitution and origin of coal. The earliest records of work of this character are found in Henry Witham's paper published in 1833, in which he tentatively supposes that such traces of organization as he had found were indicative of some monocotyledonous plant. Other eminent scientists who studied the subject were Huxley, W. C. Williamson, and Sir William Dawson, but their researches were hindered by the difficulty of producing a thin enough

Imperial University. As regards technical innovations, gunpowder was first used in 1862, and between 1885 and 1890 rock-drills and dynamite were introduced, also aerial ropeways, Frue vanners, water-turbines, and water-jacket furnaces. Electricity, generated by water-power, was first adopted in 1889 at the Ashio copper mine, and in 1893 the bessemerizing process for copper matte was introduced. The next innovation was the use of the cyanide process at the Satsuma mine in 1897, and this was followed by the adoption of pyrite smelting at the Kosaka mine in 1900. In more recent years the adoption, by Japanese mine-

section to be translucent under the microscope. The same trouble faced Mr. Lomas and his co-workers, but they have overcome it by persistence, and their results as shown by the lantern and in the coloured illustrations accompanying this paper are of immense importance to the engineer and biologist. The microscopic examination confirms the previous suppositions of the presence of megaspores and microspores, and reveals the heterogeneous and variable composition of even the apparently homogeneous coals. Each seam of coal is found to have its own special structure and characteristics, such as the thickness, diameter, and ornamentation of the megaspores, and other bodies included. The vast difference in the processes by which the vegetable debris that forms the coal has been accumulated is clearly proved. Most coals are found to have a laminated appearance, that is, they consist of alternate bands of bright and dull coal; even the brightest coal when sliced thin has this laminated structure. The dull parts are formed of bands composed of numerous megaspores in a ground mass of microspores, and the bright parts are composed of the microspores together with highly compressed remains of leaves and other vegetable tissues. Many of these brighter coals contain much resinous matter, and occasionally the woody tissues partake of the nature of charcoal. All the brighter coals may be classed genetically as 'humic'; that is, they have the appearance of having originated from the fall of leaves, twigs, seeds and fruit in the forest. On the other hand there are many coals of duller characteristics, such as cannel, composed entirely of megaspores and microspores, that had their origin in vegetation that has drifted into water. These coals have been called 'sapropelic' by Potonié, of Berlin, sapropel being a substance similar to a gelatinous mass or slime that results from the decomposition of animal and vegetable matter in stagnant water. Many of these coals contain the fossil remains of fishes, a fact confirming the supposition of their formation under water. Mr. Lomax has made and examined hundreds of slides cut from various English coals, and he describes the characteristics of the various vegetable organisms discovered. His paper ranks among those of prime importance in the domain of geological literature.

# CURRENT LITERATURE.

**Electric Winding Engines.**—*Engineering* for December 8 contains a description of the electric winding engines erected at the West Rand Consolidated gold mines by the British Westinghouse company.

**Mine Dust.**—In the *Colliery Guardian* for January 5, T. Campbell Futers describes an automatic apparatus for sprinkling water, used for the purpose of laying the dust raised in charging cars, invented by H. L. Baines of the Eldon colliery.

**Square-Set Timbering.**—The *Mining and Engineering World* for December 30 prints a paper by F. L. Burr describing the application of the square-set at the Vulcan iron mine, Michigan.

**Estimating Reserve.**—In the *Engineering and Mining Journal* for December 16, F. H. Probert and R. B. Earling describe the methods of estimating ore reserves at Ray Central mine, Arizona.

**Copper Deposits.**—*Economic Geology* for November contains a paper by Waldemar Lindgren discussing certain methods of deposition of copper ores in basic rocks, the most interesting relating to the occurrence of native copper in conjunction with zeolites in basic lavas.

**Literature of Ore Deposits.**—In the *Mining and Scientific Press* for January 6, Walter Harvey Weed reviews the literature published during 1911 on ore deposits.

**Replacement Orebodies.**—We have on a previous occasion in this column referred to the paper, presented by J. D. Irving to the Canadian Mining Institute entitled 'Some Features of Replacement Orebodies, and the Criteria by Means of which they may be Recognized,' when it was reprinted in *Economic Geology*. The full paper is now issued in the *Quarterly Bulletin* of the Canadian Mining Institute for December. The paper is probably the most important relating to the geology of ore deposits published during 1911. It is also reprinted in 'Types of Ore Deposits.'

**Volatilization of Zinc.**—At the January meeting of the Institute of Metals, Thomas Turner, professor of metallurgy in the University of Birmingham, read a paper describing experiments on the melting of brass in vacuo, which showed that, if the brass is kept at a temperature not much higher than the melting point of copper, the zinc will be removed by distillation and an effective separation made. These experiments may be of some value in considering the suggested process for using suction in zinc retorts.

**Progress in Cyanidation.**—The *Mining and Scientific Press* for January 6 contains Alfred James's annual review of progress in cyanidation.

**Cyanidation at Chispas, Mexico.**—In the Columbia *School of Mines Quarterly* for November, Edward L. Dufourcq describes the new cyanide plant at the Chispas mine, Sonora. The ore contains both gold and silver, and the high-grade sulphide is removed by Wilfleys and sold to the smelters. Hitherto the tailing has been treated by pan-amalgamation, but in the new plant it is to be tube-milled and cyanided.

**Pyrite Smelting.**—In the *Engineering and Mining Journal* for January 13, George A. Guess contributes a paper giving his views as to what constitutes pyrite smelting; namely, that it consists of the production of a silicate slag high in iron from a charge containing its iron as sulphide, the question of the relative amount of coke having no bearing on the subject.

**Metallurgy of Copper.**—Thomas T. Read reviews the progress in the metallurgy of copper during 1911 in the issue of the *Mining and Scientific Press* for January 6. The article is made additionally interesting by a table giving the names of the smelters in the United States and the nature of their products.

**Sampling Copper.**—In the *Engineering and Mining Journal* for December 16, D. M. Liddell discusses errors in sampling copper introduced by the shape of the bars or slabs.

**Galvanizing.**—*Revue de Metallurgie* for January contains an extensive review of the science and practice of galvanizing, by M. Sang.

**Volatilization of Gold.**—In the Columbia *School of Mines Quarterly*, E. F. Kern and A. A. Heimrod give the results of their experiments undertaken with the object of ascertaining the extent to which gold is volatilized during the melting of blister copper preparatory to its being cast into anode bars. Their general conclusion is that gold is not volatilized, but that after long heating the gold and copper form carbides which are volatilizable to a small extent.

**Mining in Spain.**—In the *Mining and Scientific Press* for January 6, Henry F. Collins writes on mining conditions in the south of Spain.

*Copies of the original papers and articles mentioned under 'Précis of Technology' and 'Current Literature' can be supplied on application to The Mining Magazine.*

# BOOKS REVIEWED

TYPES OF ORE DEPOSITS. Edited by H. Foster Bain. Cloth, octavo, 378 pages, illustrated. San Francisco: *Mining and Scientific Press;* London: *The Mining Magazine*. Price 10s. 6d.

This represents a new treatment of a subject that is of perennial interest to those engaged in mining. Instead of giving the views of one authority on the diverse manifestations of geological action in its relation to mineral aggregates, this book furnishes the observations and opinions of 13 writers, each dealing with the particular type of deposit most familiar to him. Thus the book illustrates the diversity of conclusion attainable on such a complex subject, while at the same time exhibiting the variant type of the deposits themselves. Yet the diversity is not without harmony, both in nature and in literature. General chemical and physical laws underlie the distribution of ore, and a general recognition of basic principles links the various views expressed by the writers who have collaborated with Mr. H. Foster Bain in the preparation of this volume. Only two Britishers find a place; but this is not surprising, for the science of ore deposits in its application to economic geology and to the industry of mining is largely of American growth. It is a pity that Messrs. Waldemar Lindgren and F. L. Ransome are not contributors. Perhaps they will repair the omission in a later volume. We should like to have seen Messrs. Malcolm Maclaren and James M. Bell elucidate some of the many ore deposits for which Australia and New Zealand are famous. It would also be a compliment to Anglo-American publishing enterprise if Messrs. De Launay, Duparc, Vogt, and Beck could have participated. However, it is not too late; for unless we are much mistaken, the success of this volume will call for a successor, prepared by others who have taken part in the development of a science so fascinating. The present volume contains 14 chapters, one of these being the admirable introduction by the editor, Mr. Bain. The others are on 'The Clinton Type of Iron-ore Deposits,' by C. H. Smyth Jr., professor of geology in Princeton University; 'The Lake Superior Type of Iron-ore Deposits,' by C. K. Leith, of the United States Geological Survey; 'Flats and Pitches of the Wisconsin Lead and Zinc District,' by H. Foster Bain, formerly State Geologist of Illinois and now editor of the *Mining and Scientific Press*; 'Lead and Zinc Deposits of the Ozark Region,' by E. R. Buckley, formerly director of the Bureau of Mines and Geology of Missouri; 'Native Copper Deposits,' by Alfred C. Lane, State Geologist of Michigan; 'Cobalt District, Ontario,' by the late S. F. Emmons, of the U. S. Geological Survey; 'Geology at Treadwell Mines,' by Oscar H. Hershey, a mining geologist in private practice; 'The Saddle-Reef,' by T. A. Rickard, formerly State Geologist of Colorado; 'Contact Deposits,' by James F. Kemp, professor of geology in Columbia University; 'The Conglomerates of the Witswatersrand,' by F. H. Hatch, who was recently retained by the Government of Natal; 'Replacement Orebodies,' by J. D. Irving, professor of geology in Yale University; 'Outcrops of Orebodies,' by William H. Emmons, of the U.S. Geological Survey; and 'Some Causes of Ore-shoots,' by R. A. F. Penrose, lately professor of geology in Chicago University. The recital of the subjects and the authors will assuredly whet the curiosity of the student, whether he be the callow youth undergoing his preliminary training or the experienced hand who makes all knowledge his patrimony.

T. A. R.

GEOLOGY OF A PORTION OF THE CENTRAL WITWATERSRAND. By E. T. Mellor. Being part of the South African Geological Survey's Report for 1910. Pretoria: Government Printing and Stationery Office. Price 7s. 6d.

I have chosen the title of this review from Mr. Mellor's chapter of the report for 1910 of the Geological Survey of the Union of South Africa, because it is of greater immediate economic importance at the present time than the other parts of the report. The area mapped by the Survey during 1910 was mainly confined to a strip of country lying north of the Main Reef series and extending from the farm Witkopje No. 157 on the east to near the township of Maraisburg on the west, and occupied for the most part by the Lower Witwatersrand System. After a short introduction and a statement of the physical features, Mr. Mellor proceeds to deal with the geology, in doing which he adopts and confirms the nomenclature of the beds, originated by his many worthy though unofficial predecessors. For the purpose of more easy description he divides the Lower Witwatersrand Beds by means of the Hospital Hill quartzites, first considering those below, then these quartzites themselves, and finally those above them. The beds below, he says, are well exposed over a distance of more than 20 miles in the area now mapped, so that a normal succession of its members may be determined with some confidence. With regard to the beds above, he points out that those in the area under review are, when compared with those in the Western Rand, apparently so incomplete that they cannot be considered as representing a normal section. This apparent diminution going from west to east, which he says has universally been attributed to a thinning of the series as a result of the original conditions of sedimentation, he thinks may be more clearly explained by the elimination by faulting of some of the beds in the Central Rand, in which elimination the shale beds have especially suffered. Olver however in his book just published explains the apparent thickness of the beds in the West Rand by the duplication of the beds there, an explanation which leaves the section in the Central Rand more normal than Mr. Mellor apparently considers it. This alternate view, however, does not detract from the interest or importance of the faulting of which Mr. Mellor has mapped the evidence in the area under consideration. There is, he says, a line or zone of maximum faulting, which he followed for over 20 miles, running east and west, and which he found everywhere marked by a pronounced contrast in the degree of dip shown by the beds which it divided, those to the south being high, whilst those to the north are much lower. It is along this line that all the most difficult points of local geology arise, including the much debated and still unsettled question of the banket beds occurring at Langerman's Kop and at Rietfontein. This fault zone he is of opinion represents the broken junction of an original anticline to the north with the present syncline to the south, with which syncline the banket beds above mentioned have no direct connection, their position being rather related to the fault-line than to the bedding-planes in general. He is further of opinion that these beds at Rietfontein and at Langerman's Kop may be correlated with the Elsburg Series, which series he regards, with most geologists, as being unconformable with those of the Witwatersrand. Differing, however, from the present balance of opinion, he concludes that the evidence tends to show that the Klipriversberg amygdaloid was extruded and in position before the faulting occurred, suffering thereby the same folding and deformation as did the

older beds. There is no doubt that this work of Mr. Mellor is the best with which the interested public has been served as yet, and though his correlation of the Rietfontein Series with the Elsburg may not afterwards be confirmed, there remains little doubt that the eventual solution of this problem will be largely founded upon the work here presented.

S. J. TRUSCOTT.

FAULTS AND DYKES; A GEOLOGICAL STUDY OF THE WITWATERSRAND. By J. S. Olver. Cloth, octavo, 295 pages, with many illustrations. Cape Town: J. C. Juta & Co.; London: *The Mining Magazine*. Price 21s.

This book consists of a series of assays or papers upon the faults and dikes found on the Witwatersrand goldfield, and their effect in displacing the 'reefs.' It is divided into two parts, the first dealing with the subject matter in detail, and the second with the larger movements and more especially with the question of the correlation of the Rietfontein or the Du Preez series, which according to the author is but a faulted portion of the Main Reef series.

Chapter I gives the nomenclature of the various classes of faulting, as such nomenclature is usually accepted on the Rand. It may be remarked that these definitions are local to the Witwatersrand, and not of universal acceptance. In the second chapter the different ways of measuring and representing fault-movements is discussed. It is seen throughout this part of the book that the author finds great difficulty in throwing his lot in with the scientists on the one hand, or with the practical miner on the other. In the third chapter the measurement of the movements is considered further and in greater detail. In the fourth chapter the author deals with movements along the reef-planes, movements which from the greater possible area of play in the case of stratified formations, are rather connected with bedded than with fissure deposits. In this chapter there is much of great interest, and the importance of such movements receives due notice, as far as I know, for the first time.

In the fifth chapter the disentanglement of the different dikes and faults is considered, so that they may be all set out in proper chronological order, without which no proper calculation of other possible effects would be possible. In the sixth, the important points to observe underground in connection with faults and dikes are discussed. The whole review of these movements is brought eventually to an end in the next chapter, by a consideration of the importance of normal faulting, and of the possible effect of the tilting of the strata in transferring what were originally normal faults, to reversed faults, or vice versa. In all of these chapters the subject is presented in great detail, indicating that the author had been able, in carrying out his ordinary duties, to make full notes of many occurrences; the presentation, however, suffers from the insufficient support the diagrams give to the text, and it is to be regretted that illustrations from actual mine plans have not been used.

One particular occurrence of dikes upon the Rand appears to have escaped mention, namely, that of the interbedded dikes found occupying constant horizons over considerable areas. Though these have been more particularly noticed in the boreholes put down in the far eastern portion of the Rand, yet they are nevertheless of some importance throughout. It is to be remarked also that no mention is made concerning the possible effect of dikes upon the distribution of the gold in the banket.

In the eighth chapter the author describes the natural characteristics of the principal 'reefs' and indicates the importance of observing the quartzite in the immediate walls of the 'reef,' as these also have their persistent characteristics. It is to be remarked that no ore-shoots comparable to those characteristic of ordinary lodes are mentioned by the author, but that a distribution best described as 'patchy' is found everywhere. In this chapter the practicability of mining low-grade ore is discussed and, within limits, approved, but wholesale mining is not favoured.

In the second part of the book the author discusses larger issues, starting in the first chapter with a comparison of the Main Reef Series of the Central Rand with the same Series as found in the Kleinfontein district, and finding these two occurrences representative of the same Series in their respective districts. Turning to the Rietfontein 'reefs,' he finds them similar to those of Kleinfontein, hence the 'reefs' at Rietfontein, on petrological grounds, belong to the Main Reef Series. This chapter is interesting, but would be more convincing with illustrations of typical sections.

Setting out to show the possible nature of the displacement which has resulted in placing a portion of the Main Reef Series at Rietfontein, the author goes to the other end of the Rand and discusses, in the second chapter, the section of beds found at Witpoortje. He makes a good case that the beds which underlie the faulted portion of the Main Reef Series in the Western Rand represent the Lower Witwatersrand Beds practically in duplicate. Till now it has always been considered that these beds in the West Rand represented a normal section, larger it is true than the same section elsewhere, but nevertheless above suspicion. The author's work will most probably require this view to be amended and that the existence of a large east and west fault, which he terms the Orange Grove fault, be here recognized, causing the duplication. Along the same line of section at Witpoortje, continued south to pick up the other terminal of the Main Reef Series, the Witpoortje fault itself is projected, together with another which the author calls the North Rand fault. These two faults between them the author holds responsible for the break in continuity of the Main Reef Series, the North Rand fault having slided the formation to the west, and the Witpoortje having brought back a more northerly section to the east, leaving the two present terminals separated by a width of Lower Witwatersrand Beds striking more or less east and west. In this line of section, therefore, there are three separate exposures of these lower beds, of which the author claims as the uppermost that which can be traced continuously from this point to the Central Rand, although heretofore the lowermost has been the only one recognized. It has been admitted all along that the beds in the author's second exposure were similar to the accepted normal of these beds, but geological thought did not rise to the conception of duplication, considering rather that the extra beds found in the West Rand were additional sedimentaries which the lenticular habit allowed to be interposed. The author makes a good case in this chapter and marshals a large number of powerful faults ready to take east to Rietfontein. In the third chapter, the North Rand fault is more fully considered. The author thinks that it is the most important of the trio, and he connects it with the Bezuidenville fault of Gibson, Hatch, and Corstorphine and with the Rietfontein fault of Mellor, whereby its existence in the far east Rand is secured. In the fourth and last chapter the author, having brought the Witpoortje and Orange Grove faults actually as far as Johannesburg, finds their counterparts at Rietfontein, where in conjunction with

their above-mentioned companion, they have brought back the Rietfontein Series as a broken portion of a hidden northern outcrop to its present position. In this the author has proceeded at a pace which even his sympathetic critics will consider unwarranted, more especially as a basis for any dogmatic statement. Yet it must nevertheless be conceded to him that where Gibson started, Hatch and Corstorphine continued and Mellor enlarged, so he has brought more fully home the extent to which it is likely that longitudinal faulting has taken place in the Lower Witwatersrand Beds. In several places the author states his disagreement with the readings of Mellor at particular points, and it would appear from his statements that these opinions of his are well held.

S. J. TRUSCOTT.

HISTORY OF GEOLOGY. By Horace B. Woodward. Cloth, small octavo, 150 pages, illustrated. London: Watts & Co. Price 1s. For sale by *The Mining Magazine*.

This book is one of the series of small handbooks published by the Rationalist Press Association, entitled 'History of Science Series.' Many noted men have contributed to these publications. H. B. Woodward is well qualified to write on the history of geology, and he has given us a concise record of the work of the great scientists who have gradually built up our knowledge on this subject. Such records should be kept at hand for reference so that people should always be able to give due credit to the right person. This thought is suggested by certain correspondence in the financial papers last month, referring to the discovery of coal in Kent. A reference to this book would have obviated the blunder of giving the credit to whoever happened to make the loudest claim, and would have revived memories of such celebrated geologists as De La Beche, Godwin Austen and Boyd Dawkins. We may add that the book does not touch on the question of ore deposits, but sails the serener waters of pure science. The book is made additionally interesting by the inclusion of numerous portraits.

THE COAST SCENERY OF NORTH DEVON. By E. A. Newell Arber. Cloth, octavo, 270 pages, with many illustrations. London: J. M. Dent & Sons. Price 10s. 6d. For sale by *The Mining Magazine*.

This is in every sense a charming and instructive book. The author is lecturer on paleobotany at Cambridge, and for many years he has been in the habit of exploring the unfrequented coast of North Devon, Somerset, and North Cornwall. Though originally more interested in fossil flora, the call of structural geology was felt by him strongly, owing to the exceptional opportunity for study afforded by the coast line in this part of the West of England. The watershed of North Devon follows the line of the coast at some places only 2 miles inland and at most not more than 4 miles. Consequently the descent to the shore is steep and the shores are confined and rocky. Southward of the watershed the rivers Tamar and Exe cross to the other side of Devonshire and debouch into the English Channel, while the Torridge and the tributaries of the Taw turn northward again and fall into the estuary at Barnstaple where the only substantial outlet into the Irish sea occurs. The high lands of Exmoor and the country around Ilfracombe consist of Devonian rocks, and between Barnstaple and Bude the country is composed of upper Carboniferous. This tract has probably never been submerged since Carboniferous times. No igneous rocks are found here, but further south, beyond the tract covered by this book, there is the great boss of granite forming Dartmoor. No mineral deposits are found until the latter district is approached. Mr. Arber divides the country into six sections convenient for separate study, namely, Lynton and Porlock, Ilfracombe, Mortehoe, Clovelly, Hartland, and Boscastle. Some of these centres are fairly well known to the tourist, but the coast from Clovelly to Bude is far out of the beaten track. The Hartland district is fascinating, owing to the number of waterfalls that fall down the cliff right on to the beach. The second part of the book is devoted to studies of special questions such as the marine erosion of folded rocks, the evolution of the coastal waterfalls, and the sea-dissected valleys. The book is not written in too highly technical language, and a useful chapter is provided on the elements of structural geology, that is a sufficient introduction to the subject for the person of average intelligence. The accompanying illustration gives a characteristic example of the sharply-folded strata of North Devon.

MINERALOGY. By F. H. Hatch. Cloth, small octavo, 250 pages, illustrated. London: Whittaker & Co. Price 4s. For sale by *The Mining Magazine*.

The first edition of this book appeared 20 years ago, and it has been reprinted twice without substantial alteration. The present edition has been practically rewritten with much additional matter, and we are glad to welcome the book back into the current literature of the day. The book is in two subdivisions, the first discussing the systems of crystallization, the physical properties, and chemical composition of minerals, and the second describing the more important species that make up rocks, or occur as ores, salts, or precious stones. Only those are included that are either widely distributed or are sought for specific industrial purposes. The information as to the most important occurrences of the various minerals is of considerable practical value. We are sorry to find that Mr. Hatch is not yet converted to the modern mineralogical term 'pyrite,' still preferring the old Greek form 'pyrites.'

THE METALLURGY OF STEEL. By F. W. Harbord and J. W. Hall. Fourth edition, enlarged and revised. Two volumes, 950 pages, with many illustrations. London: Charles Griffin & Co. Price 36s. For sale by *The Mining Magazine*.

For the last half-dozen years Harbord's 'Metallurgy of Steel' has been acknowledged as the best general treatise on the subject, though other writers have enriched the literature by books that contain more specialized information on various branches of theory and practice. Our knowledge of steel in recent years has been substantially advanced by the studies of metallographists, and the practice in its manufacture, especially in regard to special steels, has been notably modified by the introduction of electric heat. It has therefore become necessary to rewrite the book in a greatly enlarged form. The book possesses a feature distinguishing it from others, in that J. W. Hall's section of it describes the methods of treating the steel ingot after it has been made, and gives the details of rolling-mill practice, forging, tube and wire manufacture. In the present edition it has been found necessary to divide the book into two volumes, of which the first is Mr. Harbord's share and the second Mr. Hall's.

To go through the whole of the two volumes would be impossible here. We may, however, say that Mr. Harbord's section commences with 50 pages on the practice of the acid Bessemer process, followed by details of the basic and other modifications of the converter, and dissertations on its chemistry. The open-hearth process takes 130 pages, and in this connection

the latest information relating to charging machines and gas-producers is given. Chapters follow on the production of steel castings, the manufacture of shear and crucible steel and of armour-plate, and on direct processes of steel-making. A chapter on electric furnaces gives a comprehensive survey of the present position, though it includes a notice of a furnace that has by no means won its spurs as yet. The second half of Mr. Harbord's part is devoted to theoretical considerations relating to the testing of steel, the combinations and mixtures of carbon and iron, the influence of sulphur, phosphorus, silicon, manganese, and many other elements, on the physical properties of steel, etc. The chapter on metallographic and microscopic research has been greatly enlarged and brought up to date.

Mr. Hall commences with a description of re-heating furnaces, and then discusses the various types of rolling mills, section mills, plate mills, rod mills, etc. subsequent chapters deal with the steam hammer, hydraulic presses, tube and wire making, and methods of protecting steel from corrosion. A part of the book that has been considerably extended is that devoted to the supply of power to rolling mills and other machinery used. As the load is intermittent and irregular, a special study of this problem is requisite. Mr. Hall compares steam, gas, and electricity, and his information and views on the subject are of interest in other directions than in their direct application. We may suitably conclude this review by saying that the new edition will worthily prolong the life of a treatise of established reputation.

ELEMENTARY TEXT-BOOK OF METALLURGY. Fifth Edition. By A. Humboldt Sexton. Cloth, octavo, 260 pages, illustrated. London: Charles Griffin & Co. Price 6s. For sale by *The Mining Magazine*.

This book was originally published in 1894, and has filled the useful purpose of giving the student and the general reader an outline of the main principles and processes of metallurgy. The first chapters deal with the properties of metals, chemistry of combustion, fuel, refractory materials, occurrence of metals in nature, the different types of furnaces, preparation of ore by crushing, dressing and roasting, and the nature of the various metallurgical reactions. The subsequent chapters deal with the chief metals, iron, copper, lead, zinc, tin, silver, gold, mercury, and the alloys. There are also chapters on electro-metallurgy and practical chemistry.

ELEMENTARY COAL-MINING. Third Edition. By George L. Kerr. Cloth, small octavo, 230 pages, illustrated. London: Charles Griffin & Co. Price 3s. 6d. For sale by *The Mining Magazine*.

This book is so well known to students of coal-mining that it is not necessary to recapitulate its contents here. The new edition is enlarged and revised, and the detection of fire-damp and methods of timbering are treated at greater length.

PRACTICE BEFORE THE COMPTROLLER OF PATENTS. By Carrol Romer. Cloth, octavo, 320 pages. London: Sweet & Maxwell. Price 10s. For sale by *The Mining Magazine*.

Though the Comptroller has extensive powers in the granting of patents, and a jurisdiction connected with opposition, amendments, etc., a standard of practice before his court has never before been the subject of a book. Indeed very few of his decisions have ever been made public, so that they have not been available for the guidance of others. We may safely say that all patentees or intending patentees should see this book.

MINING MATHEMATICS. By S. N. Forrest. Cloth, small octavo, 300 pages, with diagrams. London: Edward Arnold. Price 4s. 6d. For sale by *The Mining Magazine*.

The author is lecturer in the Glasgow Technical College, and the book is intended to cover the two years' course in mining mathematics. It includes ordinary arithmetic, mensuration, algebra, trigonometry, logarithms, and the plotting of curves, besides a great number of mining formulas. The examples and problems are all connected with the everyday life of the miner.

FORECASTING WEATHER. By W. N. Shaw. Cloth, octavo, 380 pages, with many diagrams and illustrations. London: Constable & Co. Price 12s. 6d. For sale by *The Mining Magazine*.

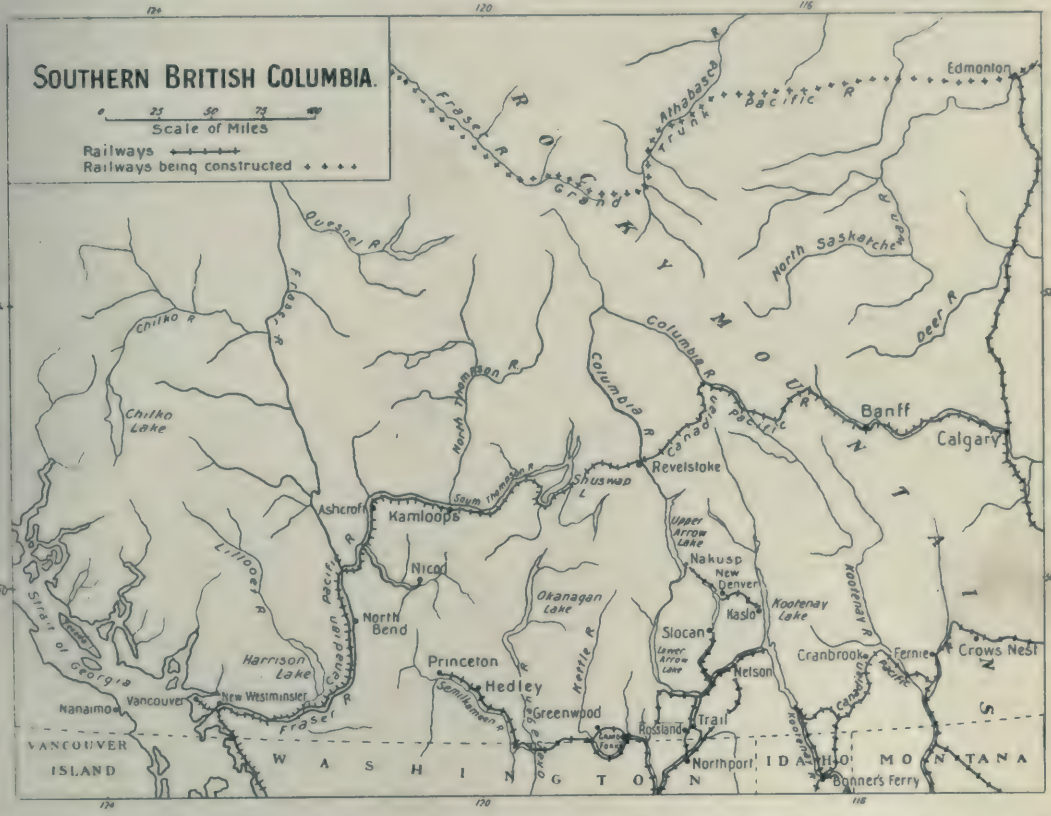
Mining engineers are not wanting in advisers as to the desirability of adding a multitude of subjects to their curriculum of study, and we therefore hesitate to press unduly the claims of the weather upon their notice. Yet the travelled engineer gets a good deal of weather of one sort and another: aridity in Arizona and West Australia, heat and moisture in West Africa and Colombia, frost in Alaska and Siberia, torrential rains in Malaya, rarified air on the Bolivian plateau, and drizzly mists in Cornwall. Much of his work is regulated and indeed limited by weather conditions, of either a permanent or accidental nature, and he is bound to take an intelligent interest in the signs and portents of the heavens. To the coal miner, the weather assumes an importance of a different kind, in that it is supposed to have some influence on the likelihood of explosions.

In all probability, Mr. Shaw knows as much about weather as anybody, for he has been head of the Meteorological Office for eleven years, before which he was connected for twenty years with the Cavendish physical laboratory at Cambridge. He is in the favoured position of having access to daily information from all parts of Europe and from certain stations in North Africa, Asia, and America, so that he has a profound advantage over the mining engineer isolated in a distant country. Nevertheless his book shows that, broadly speaking, weather effects in the British Isles may be deduced from a few main lines of investigation and happenings, and an intelligent man should be able to apply his lines of reasoning to the physical conditions characteristic of his particular district.

As regards the application of weather conditions to coal mining, the experts in various countries are working at cross-purposes, and Mr. Shaw is somewhat mystified as to their respective claims. In America it is supposed that a low barometer conduces to the release of explosive gases, while in England a high barometer is taken by many as a danger signal, as it is conducive to the drying of the coal dust and its consequent inflammability and tendency to rise in the air. Mr. Shaw points out that the philosophy of the subject, as treated by mine managers, is so imperfect as to afford no data for argument, for the only records are those in connection with the few actual explosions, and not with conditions tending to encourage them. His point is made clear if we say that the correctness or otherwise of storm warnings for mariners is proved by the ensuance or otherwise of gales and not of wrecks. Consequently in the absence of proper records, he declines to commit himself, and his firm attitude and the expression of his views should convey the needful hint to those who have this subject at heart.

# COMPANY REPORTS

**Le Roi No. 2.**—This company was floated in 1900 by the late Whitaker Wright for the purpose of working the Josie, Poorman, and adjoining copper-gold properties at Rossland, British Columbia. Subsequently the management was placed in the hands of Alexander Hill & Stewart, who have been successful in conducting operations at a profit under circumstances which were originally far from promising. The report for the year ended September 30 last shows that development and prospecting by means of the diamond drill have continued to disclose new veins and shoots. The total footage of development work was 5577, and 14,932 ft. of diamond-drilling was done. The most important discoveries were a new vein called the Holywell, and a new shoot in the North Annie




vein. During the year, 67,033 tons of ore was raised. Of this, 22,414 tons was discarded as waste, 27,098 tons was shipped to the smelter, and 17,521 tons concentrated. The shipping ore was estimated to contain 1·6% copper, 16·7 dwt. gold, and 0·7 oz. silver per ton, having a gross value of $21 per ton, and net value, after deducting smelting charges, of $15·20 per ton. The concentrating ore averaged 0·5% copper, 2·8 dwt. gold, and 0·2 oz. silver per ton, and 1589 tons of concentrate was produced, averaging 1·29% copper, 1·425 oz. gold, and 0·75 oz. silver per ton, having a gross value of $32 per ton and net value, after payment of smelter charges, of $25·50. The receipts for ore and concentrate were £84,806, and other receipts brought the income for the year to £91,474. The divisible profit was £30,176 which, added to the balance brought forward, made a disposable amount of £74,181. Out of this, £1700 went as directors' share of profits and £36,000 as dividend, being the same as during the year before. Owing to the inflated capital, £600,000, a legacy from the previous controllers, the rate of dividend seems unduly small. At the meeting of shareholders the directors announced that in future the dividend was to be restricted to £12,000 per year, or 2s. per £5 share, in order that more money might be placed to reserve. The object of this new policy was to make it possible to prosecute development more actively in certain untried parts of the mines and to search for new properties. Ernest Levy, the manager for Alexander Hill & Stewart gave much additional information as to future prospects.

**Van-Roi.**—This company was formed in 1908 as a subsidiary of the Le Roi No. 2 for the purpose of acquiring the Vancouver group of silver-lead-zinc properties in the Slocan district of British Columbia. The capital is £34,500, divided into 30,000 preference shares of £1 each and 90,000 ordinary shares of 1s. each. The purchase price was £20,000 cash paid to the local owners, and 60,000 ordinary shares paid to the Le Roi No. 2 company. At first, the company continued to send the ore to the Wakefield mill for concentration, but this arrangement ceased in August 1910. Subsequently a new mill was built on the other side of the mountain, and an adit driven to deliver the ore thither; also the aerial tramway was moved to the new position. Operations restarted on March 15 of last year. The report now issued, covering the year ended September 30, shows that during the 6½ months, 22,427 tons of ore was sent to the concentrator, averaging 3·74%

lead, 7·8% zinc, and 9·46 oz. silver. The production was 1214 tons of lead concentrate, averaging 65·3% lead, 9·1% zinc, and 89·7 oz. silver, and 1598 tons of zinc concentrate averaging 45·5% zinc, 1·7% lead, and 29·6 oz. silver. The tailing assayed 0·1% lead, 4·65% zinc, and 3·26 oz. silver. The profit and loss account shows a debit of £2661. Since the end of the year under review, the company has been making a profit, and the directors write hopefully of the future prospects.

**Brilliant Extended.**—This company is incorporated in Queensland and has been operating the gold mine of that name in the Charters Towers district since 1895. The property is a deep level immediately adjoining the Brilliant & St. George. W. A. Macleod is manager. The metallurgical equipment consists of 15 stamps, 5 Huntington mills, and cyanide plant. The report now issued covers the half-year ended November 16 last. During this period 27,580 long tons of ore was milled. The bullion extracted by amalgamation was worth £24,917, and by cyanide £12,289. In addition, 1306 tons of concentrate was produced, which was sold for £23,426 net. The total receipts were therefore £60,632, or 43s. per ton. The costs were as follow: mining £35,996, milling and cyaniding £10,665, administration £707, tax £625, and depreciation £2637. The dividend absorbed £12,500, being at the rate of 1s. per 10s. share. The ore reserve on November 16 was estimated at 40,000 tons, averaging 45s. realizable content.

**South Kalgurli.**—This gold mine is situated to the south of the Kalgurli and to the west of the Perseverance at Kalgoorlie, West Australia, and has been producing since 1900. In the early days, much trouble was experienced with the sulpho-telluride ore, and many methods were tried. Finally dry-crushing, roasting, fine-grinding, and cyaniding was adopted. For the last five years the ore has averaged between 6 and 7 dwt. During the year ended September 30, 112,170 tons of ore was raised and treated, yielding 33,954 oz. gold, worth £143,945. The profit, after due provision for depreciation and development, was £20,465, out of which £20,000 was distributed as dividend, being at the rate of 10%. John Morgan, the manager, reports that during the year the Main shaft was sunk to 1818 ft. and the 18th level opened up. Connection has been made with workings on the adjoining Kalgurli property, so that ventilation has been greatly improved. At the 18th level, a cross-cut east has reached the Kalgurli boundary without cutting any ore; the cross-cut west has not yet reached the Lake View lode, but has passed through three lodes that may be worth developing, though the assay-values so far obtained do not average over 3 dwt. per ton. Development work in the mine generally has been satisfactory, and rather more ore has been proved than was extracted during the year. On September 30, the reserve was estimated at 173,200 tons, with a content of just over 6 dwt., while, in addition, the 'probable' ore was 67,500 tons, estimated to contain 5½ dwt.

**Associated Northern Blocks.**—This company was formed in 1899 to acquire the Iron Duke and adjoining leases at the northern end of the 'Golden Mile' at Kalgoorlie, West Australia. The control is in the same hands as the Associated Gold Mines, but the management of the two companies has for the last year and a half been separated. George M. Roberts has continued as manager of the Northern Blocks, while D. McCaulay is now in charge of the Associated. As we recorded a year ago, the Northern Blocks made excellent profits from 1901 to 1910, but two years ago it was evident that the ore was becoming rapidly exhausted, and in consequence the directors commenced to look for new properties. The present report, covering the year ended September 30 last, shows that development and diamond-drilling have given no results, and that the time is approaching when the mine should be let on tribute and the regular working of the mill abandoned. During the year 18,158 tons of ore was raised from the mine, and yielded 8936 oz. gold, worth £38,026. The mill also treated 4450 tons of tributors' ore, yielding 2712 oz. gold, worth £11,519, and 10,428 tons of custom ore, yielding 11,024 oz., worth £46,836. The working account shows a balance of profit of £16,325, and interest from investments, forming the reserve fund, brought an additional £3892. Against this were the items of London expenses £3838, depreciation on investments £4825, exploration account £7035, etc., so that the remaining balance was only £1122, which was carried forward. During the year, options were acquired on the Gimblet South Extended property at Ora Banda, and the developments have been sufficiently satisfactory to warrant the company completing the purchase at a price of £22,500. The ore developed amounts to 163,000 tons, with a content of 23s. per ton, and the cost of treatment is estimated at 10s. per ton. Two years ago the company acquired the El Refugio group of silver-gold mines at Salinas, in the State of Zacatecas, Mexico, and sent W. E. Simpson to do development work. He now reports that operations have been hindered by the late revolution, and that the exploratory work necessary to locate the fault below the old workings and above the 380-ft. level has not progressed far. He states that it is important that this question should be cleared up and the continuity of the orebody proved before any treatment plant is erected.

**Tasmania Gold.**—This company was formed in 1903 by John Taylor & Sons to acquire properties near Launceston, Tasmania, that had been previously operated by a local company. These mines had been successful gold-producers, but owing to the increase of the flow of water in depth, the continued working of the property involved a far greater expenditure on pumping plant than the local owners could afford. This capital was provided on the flotation of the London company, and the plant laid down is one of Henry Davey's best examples of the modern Cornish pump. The water trouble has not, however, been the only drawback, for the lode has proved of irregular content in depth. In 1909 the grade fell seriously, and in October 1910 it was found necessary to reconstruct the company in order to provide new capital. The nominal capital was then reduced from £500,000 to £250,000 by altering the denomination of the shares from £1 to 10s., and the new shares were issued credited with 7s. 6d. paid, thus carrying a liability of 2s. 6d., sufficient to provide £62,500 in cash. The first report of the reconstructed company has now been issued, covering the period ended September 30 last. It shows that the reconstruction of the company was successfully carried through, and that one shilling per share has been called up. During the period under review, 53,968 tons of ore was raised, from which 23,143 oz. gold was recovered, realizing £97,820. The expenditure at the mine and in England amounted to £101,913, leaving a loss of £4020. The development work has been actively prosecuted on the deeper levels, especially on the 1370-ft. level east. The results have not been altogether satisfactory, owing to the presence of a horse of country rock. The shaft tapping the lower levels has been sunk to 1530 ft., and a drift is being started at 1500 ft.

The results here obtained will determine the future of the company. The ore reserve above the 1370 ft. level is estimated at 43,084 tons, in addition to which 27,228 tons is 'partly developed,' and 30,000 tons is 'probable.' The report gives details of the improvements and alterations recently made in the stamps and concentration plant.

**Hampden Cloncurry.**—This company was formed in 1906 for the purpose of developing the Hampden and Duchess copper properties near Cloncurry, North Queensland, and it was reconstructed in 1909 when additional capital was raised. The control is with the latter company has a better smelting plant. It would also be of advantage to have a concentration plant in common. The report of the Hampden Cloncurry for the half-year ended August 31 shows that development work at the Hampder mine was greatly impeded by a flood, and that 8614 tons was raised averaging 10·4% copper. During the 4½ months that the smelter was in operation, 7939½ tons of ore was treated, yielding 2229 tons of matte containing 746 tons copper, 708 oz. gold, and 10,170 oz. silver. Developments at the Hampden and Duchess mines are reported as satisfactory. In addition two other promising properties,

Baillieu group, and the office is at Melbourne. Erle Huntley is general manager. No ore has been shipped, but a smelter was erected and put into commission in April 1911. Further plant has been provided for the purpose of improving the grade of the matte, and an additional furnace and a converter are now in course of erection. In the meantime the matte is sent to Mount Elliott. Our Melbourne correspondent has several times recently discussed the tentative proposals for the amalgamation of this company with the Mount Elliott. Particulars of the latter company were given in this column in our last issue. It is considered that the ore resources of the Hampden Cloncurry are of greater promise than those of the Mount Elliott, while the the Trekelano and the Mount Mascotte, have been acquired. The ore reserves at the Hampden are estimated at 91,000 tons averaging 8% copper; at the Duchess 130,000 tons averaging 10%; at the Trekelano 11,000 tons averaging 14%; and at the Mount Mascotte 2000 tons averaging 16%; a total of 239,650 tons averaging just under 10%. This is all ore that can be smelted direct, and there are also large bodies of concentrating ore that have not yet been touched. In all probability the line of railway connecting the Duchess, Trekelano, and Mount Mascotte with the Hampden will be completed in May. The accounts for the half-year show credits of £46,278, representing the realizable value of the production, and the expenses at the mine

were £44,602. In addition, administration expenses and interest on debentures absorbed £3229, and £2245 was written off for depreciation of holdings and abandoned options. The capital of the company consists of £250,000 in ordinary shares and there are £60,000 debentures.

**Tominil.**—This company was formed in 1906 to acquire the San Felix silver mine, in Tamazula district, Durango, Mexico, the vendors being the Tominil Syndicate. M. Parry Gosset was the moving spirit among the vendors, and he continued to act for a time as mine manager and consulting engineer to the expanded company. The mine had yielded good profits to previous owners from silver sulphide, containing a small amount of gold, that was shipped to smelters. G. W. Schneider succeeded Mr. Gosset as manager, though the latter continued to act in an advisory capacity. In 1908 the late Ernald Richardson, of Swansea, supplied additional capital, and nominated W. R. Francis to erect cyanide treatment-plant. Shortly afterward Mr. Richardson died; Messrs. Gosset, Schneider, and Francis resigned, and the management was placed in the hands of Pearse, Kingston, and Browne. Gerald Browne and Selwyn Goldstein undertook the re-examination of the mine and the re-organization of the metallurgical plant. In August 1910 the company was reconstructed, the preference shareholders taking fully-paid shares of half the par value, and the ordinary shareholders taking similarly reduced shares carrying a liability of 2s. per 10s. share. The report now issued covers the period from August 1910 to September 30 last. This shows that 444,130 shares of 10s. each have been taken up and the liability paid in full. The debenture issue of £10,000 was unaffected by the reconstruction. The disturbed condition of Mexico has interrupted the work, but not in any serious way, except by delaying the remodelling of the plant. The mill ran intermittently, and 3681 tons was treated up to September 30. From this ore, 82,259 oz. bullion was recovered, valued at £10,275. The production at the mill is now paying expenses. A large amount of development work has been done with gratifying results, the reserve of first-class ore on September 30 standing at 22,394 tons averaging £3 per ton, to which must be added about 30,000 tons of ore on the dump estimated to contain 30s. per ton.

**Bunker Hill & Sullivan.**—The report of this great silver-lead mine situated at Wardner, Idaho, covers the year ended May 31 last. F. W. Bradley is president of the company, Stanly A. Easton is manager, and the control is with the D. O. Mills estate. It has been possible to greatly increase the output of ore during the year, as the first unit of the new dressing plant is now in full operation. Details of this plant were given in our issues of May, June, and July of 1910, by Gelasio Caetani. The ore raised was 438,290 tons, of which 436,940 tons was sent to the concentrating plant, and 1350 tons shipped direct to the smelter. The concentrating ore averaged 9½% lead and 3·78 oz. silver per ton, and the shipping ore 42% lead and 16·39 oz. silver. The concentrating ore yielded: 35,777 tons of first-class concentrate averaging 58·8% lead and 21 oz. silver; 23,062 tons slime averaging 44·77% lead and 17·48 oz. silver; 1120 tons concentrate produced from tailing averaging 38·73% lead and 14·73 oz. silver; and 4647 tons of middling averaging 12·15% lead and 4·72 oz. silver. All these products were shipped to the Tacoma smelter. It will be remembered that some of the concentrate and middling is valuable for fluxing purposes owing to iron content. The recovery was 78·48% of the lead and 72·86% of the silver. The gross assay-value of the concentration products was $3,251,448, and of the shipping ore $55,945, making a total of $3,307,393. The freight and smelting charges came to $1,255,728, and the mining costs to $901,496, so that the 'operating profit' was $1,150,169. Other items of expense were $134,435 on improvements, $50,113 on exploration, $36,992 on taxes, and $50,032 on litigation. The net profit for the year was $870,986, and the balance carried forward from the previous year was $237,907, bringing the total disposable surplus to $1,108,893. The dividend absorbed $1,062,750, bringing the total distribution since 1886 to $12,701,850. Mr. Easton reports that the exploration work done during the year exposed a larger amount of ore than that which was removed, and that the reserve of ore is larger than at any previous time during the history of the company. The second unit of the West mill is being built. It will be remembered that two years ago the expensive litigation with the neighbouring company, the Federal Mining & Smelting Co., was suspended, on the decision to amalgamate the two ventures. This amalgamation has not yet been carried into effect.

**Coniagas.**—This mine at Cobalt, Ontario, was opened in 1905, and large shipments of ore were dispatched during the year 1906–7. Toward the end of 1907, a concentrator was erected. The report for the year ended October 31 last shows a great increase of output. During this time, 52,320 tons of ore was raised; of this, 619 tons of ore, estimated to contain 2,142,536 oz. silver, was shipped to the smelter, and the remainder concentrated, producing 1418 tons, containing 1,643,616 oz. silver, making the total yield 3,789,274 oz., or nearly double the produce of the previous year. The dividends distributed during the year amounted to $1,440,000. Developments underground have continued to give satisfactory results, and the ore reserve on October 31 was reported to contain over 15½ million ounces. The produce of the mine is treated by the company's own smelter at Thorold, which for convenience is operated by a subsidiary company. The control is in Canada, R. W. Leonard is president and manager, and R. P. Rogers is assistant manager.

**Tongkah Harbour Tin Dredging.**—This company was formed three years ago at Hobart, Tasmania, for the purpose of dredging tin gravel on the sea-shore on Tongkah island, off the coast of the Western Siamese States. Some account of this district was given in our issue of October 1910. We also recorded in our issue of July 1910 that a great divergence of opinion had been expressed as to the value of this property and that bitter recriminations were made by the officials of the company in connection with the reports made by independent investigators. In view of these circumstances the report for the year ended September 30 last is of special interest. The amount of gravel treated was 2,217,343 cubic yards, and the production was 1142 tons of cassiterite, which sold for £117,487, or £102. 15s. 9d. per ton. The yield was 1·15 lb. per cu. yd., valued at 12·7d. The dredging cost was £32,456 or 3½d. per cu. yd., and other charges were £8892, bringing the total cost to £41,348, or 4½d. per cu. yd. A year ago the recovery was 1·14 lb., the dredging cost 5d., and the total cost 6·2d. per cu. yd. The profit was £76,139, and with the balance brought forward from the previous year, the total balance was £98,029. Out of this, £22,500 was distributed as dividend, being at the rate of 15%, and the remainder was carried forward. During the year, the fourth and fifth Werf-Conrad dredges have been put to work, and in future it is intended to distribute quarterly dividends.

**Renong Dredging.**—This company was formed in 1908 to dredge for tin on flats adjoining the Renong and Pak Chan rivers in the Western Siam States. A Werf-Conrad dredge started operations on March 1, 1910. The property was inspected by E. T. McCarthy, who is on the board, and Frank Nicholls is manager. The report for the year ended September 30 last shows that 698,679 cubic yards of gravel was treated, and 241⅓ tons of cassiterite recovered, the yield being 0·77 lb. per cu. yd. The metallic content of the concentrate was 73%. A month was lost by timber fouling the ladder, necessitating considerable repairs. The monthly output ranged from 12 to 30 tons, a variation

which is explained by the fact that some parts of the ground had been partly worked by previous owners. The revenue from the sale of the concentrate was £30,155, and the operating expense was £14,091. In addition, £1426 was paid as directors' fees and other London expenses, and £4405 written off for depreciation. The cumulative preference dividend of 15% per annum, dating from July 1, 1909, has been paid to September 30 on the 25,000 participating preference shares of £1 each, this payment absorbing £8087. The directors propose also to pay another 5% on the preference shares and 20% on the 20,000 deferred shares of 5 shillings each. The directors report that since the close of the financial year, the dredging results have continued to be highly satisfactory.

**Dungun River Wolfram.**—This company has been formed to acquire mining rights in the State of Trengganu, Malay Peninsula, from a Singapore company called the Dungun River Concessions Syndicate, and to provide additional capital for continuing development work. The property consists of a lode of quartz containing wolfram that has yielded excellent profits on a small scale to the local Chinese owners. Osborne & Chappel, of Ipoh, Perak, have reported on the property, and made certain suggestions for the testing of the lode. Reginald Pawle and Henry Brelich are the consulting engineers. Among the directors is Sir E. W. Birch, who is chairman of the Eastern Smelting Co. The capital of the new company is £40,000, of which £20,000 in shares is purchase price and 20,000 £1 shares are being offered for subscription; of the latter 16,000 have been underwritten by Sharpe, Ross & Co., who are largely interested in the Dungun syndicate. The report by Osborne & Chappel indicates that the deposit is one of considerable promise.

**Ferreira Deep.**—This mine in the central Rand has been perhaps the greatest sufferer of any in the district from the results of insufficient provision for supporting the hanging-wall. In reviewing the progress a year ago, we mentioned that the necessary work in connection with making the mine safe had greatly interfered with the profits, and with the amount of ore raised and the development done. The report for the year ended September 30, now issued, shows that these adverse factors have not yet been entirely removed; the yield has decreased and the costs advanced. Attention has been concentrated on the packing of the dangerous parts with waste rock and with sand-tailing, of which latter 378,774 tons has been introduced during the year. More development work was done than during the previous year, and just lately it has been possible to resume shaft-sinking. The amount of ore raised was 466,213 tons and, after the removal of 19·7% waste, 373,196 tons was sent to the mill. By amalgamation and cyanide 193,646 oz. gold was recovered, equal to 10·38 dwt. per ton milled, being 95½% of the estimated content. The yield shows a decrease of 1 dwt. per ton as compared with the previous year, a fall that is due to several causes; the chief is that much of the higher-grade ore is in places where stoping is suspended until the necessary filling is introduced, but in addition much low-grade ore was mined so as to exhaust certain stopes before they were permanently closed by the filling. The shortness of the native labour supply has had an adverse effect in many ways. As regards the ore reserve, Percy Cazalet, the consulting engineer, and W. E. C. Mitchell, the manager, report that on September 30 their estimate was 1,837,808 tons averaging 9·7 dwt.; of this about one-fifth is in shaft and boundary pillars and is not at present available for extraction. The gold produced during the year realized £811,723, as compared with £873,337 the year before, and the working cost was £391,784, as compared with £334,400, leaving a working profit of £419,938 as compared with £528,937. Additional costs were expenditure on new plant £24,914, and taxes £39,138. The dividend absorbed £409,500, of which £51,712 was provided out of the balance brought forward from the previous year. This dividend was at the rate of 45%, as compared with 55% the previous year. Since the formation of the company in 1898, the sale of gold has realized £6,175,190, and other revenue has amounted to £35,442, while £550,029 was supplied as cash capital. On the other side, £2,980,250 has been distributed as dividend, £2,522,585 spent as working cost, £824,836 spent on

capital account, and £330,499 paid as taxes. The war caused additional expenditure of £71,326, and the remainder of the money is represented by cash in hand. During these years, 2,515,423 tons of ore was milled, with an average yield of 11⅜ pennyweights.

**Union Steel of South Africa.**—This company has been formed under Transvaal laws, by Lewis & Marks, for the purpose of establishing a steel-works at Vereeniging, on the Vaal river, 30 miles south of Johannesburg. The situation is favourable, as it is in the midst of the Vereeniging coalfields, and, in addition, the proximity of the new electric station now building for the Victoria Falls & Transvaal Power Co. will be of convenience in case electric furnaces are adopted. The plan at present is to confine operations to the manufacture of steel from scrap, of which a large amount is available in South Africa, and the specialties are to be tool and drill steel, mine rails, and fencing standards, besides general forgings and castings. The capacity of the works will be 10,000 tons per annum. An agreement has been made with the government, whereby scrap from the government shops will be obtainable at favourable prices; also, the government will give preferential rates for carrying scrap on the railway, so as to encourage sellers to deal with the new company instead of exporting their material to England. In three years time it is stipulated that the company shall commence experiments with a view to the manufacture of pig iron from South African ores, and one of the directors, H. H. Wright, has undertaken to transfer to the company his rights in connection with the Magnet Heights deposits in the Lydenburg district, of which he was the discoverer. The capital of the company is £250,000, divided into 247,500 preferred shares of £1 each and 50,000 deferred shares of 1s. each, the latter being paid to the vendor syndicate for the government contracts. The preferred shares take a 7% cumulative dividend, and after a similar non-cumulative dividend has been paid on the deferred shares, the remainder of the profits in any one year will be divided equally between the two classes of shares. Of the preferred shares, 100,000 have been offered to the public, and of these 80,000 have been underwritten; the company therefore makes its appearance with the necessary capital guaranteed. The appointment of a manager has not yet been definitely settled.

# TRADE NOTES

*Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.*

**Richard Klinger & Co.** are advertising their steam specialties by means of *Engineering Notes*, a small monthly booklet.

**Werf-Conrad, Ltd.,** have lost through the death of P. Goedkoop, at the age of 63, an efficient organizer of unusual executive ability. He has been general manager of this large firm for the past twenty-five years.

**Hartley, Causton, & Richmond** describe in a 70-page loose-leaf catalogue their equipment of light rolling-stock, rails, and sleepers, for tramways and light railways; also trommels, tanks, and headframes.

**Ronald Trist & Co.** have reprinted the illustrated article 'Thermofeed Regulator for Boilers' which appeared in *Engineering*, December 22 last. The device shows a much more careful study of details than is usually given to steam accessories.

**The Richards Pulsator Classifier** is now presented in the Launder type and is designed to meet the demand for an inexpensive device which may be attached to existing launder systems. The Denver Engineering Co.'s Bulletin No. 1054 describes it.

**Chalmers & Williams** have adopted a uniform 7 by 9 in. size for their bulletins and catalogues. Each subject is thoroughly covered separately, but the entire series form an important addition to well printed and edited trade literature.

**The British Humboldt Engineering Co.** have issued a special bulletin describing their new coal screening and washing plant. A complete model is being exhibited at the Science Museum, South Kensington, which is an exact copy of a recent installation in Westphalia.

**The Deister Concentrator No. 4** incorporates the latest designs of the Deister Concentrator Co., and is recommended for handling table feeds from 8 to 80 mesh and of unclassified feeds. As stated on the front cover of this issue two full-sized tables are installed at the testing works of George T. Holloway.

**The New York Engineering Co.** have added another catalogue to their list of publications on dredges and dredging equipment. They evidently are well aware of the constant changes which are being made to this important class of machinery and desire to acquaint possible purchasers with the fact that they adopt and anticipate acceptable improvements.

**H. R. Marsden** is fully alive to the fact that 50 years of experience in supplying stone-breaking, elevating, and conveying machinery must be followed up in these strenuous days of competition by good trade literature. Catalogue J of 67 pages 8 by 10 in. is well printed and illustrated, and gives prices on many of the machines.

**'Fire Concentration'** is the title given to the latest of the bulletins describing the merits of the Partridge hot-blast furnace. In this, as in other literature issued by the company, stress is laid upon the adaptability of the smelter to small properties producing refractory ore preventing the adoption of simple metallurgical methods. The London representative is A. J. Hudson.

**Internal Combustion Engines** are coming more and more into use for marine and stationary power units, and in considering equipment for light railways, this form of motive power is not to be neglected. We have received a recent catalogue describing Otto Locomotives. The British agents are W. Silverstein & Co., 147 Cannon Street. The catalogue contains important information on the operating costs of locomotives of this class.

**Richard Pape, Ltd.,** have sent us catalogues of their electric hand-lamps and 'Fors' accumulators. The lamps, being air-tight and light in weight, should be useful in coal mines and other places exposed to explosive gases. A novel feature of the accumulator is the shape of the electrodes, which consist of two concentric cylinders separated by a porous pot. This is claimed to eliminate plate-buckling and short-circuiting troubles.

**The Hardinge Conical Mill Co.'s** recent sales indicate the rapid introduction of this type of mill. The Calumet & Hecla Co. are installing 32 of the largest sized machines in their re-grinding plant. The Porcupine Gold Mines Co., better known as the Vipond Co., have ordered two Hardinge ball-mills, to be used in conjunction with two Hardinge pebble-mills. The Olla de Oro Mining Co. of Bolivia will install a 4½-foot ball-mill, and it is interesting to note that the mill will be transported across the Andes over a pass 17,000 feet above the sea.

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*Scientia non habet inimicum nisi ignorantem.*

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# STATISTICS

### Stocks of Copper in England and the Continent.
Reported by Henry R. Merton & Co.

| | Dec 31 Tons | Jan. 31 Tons | Feb. 29. Tons |
|---|---|---|---|
| In England | 42,104 | 40,182 | 37,056 |
| In France | 5,254 | 5,488 | 5,976 |
| Afloat from Chile | 1,575 | 2,300 | 2,675 |
| Afloat from Australia | 8,350 | 7,600 | 5,800 |
| Total | 57,283 | 55,570 | 51,507 |
| In Rotterdam | 5,300 | 4,900 | 3,600 |
| In Hamburg (estimated) | 8,100 | 8,200 | 7,900 |

### American Copper Producers' Association.
In Tons of 2,240 lb.

| | Production. | Deliveries | | | Stocks at end of month |
|---|---|---|---|---|---|
| | | Domestic | Foreign | Total | |
| January 1911 | 51,650 | 18,785 | 23,753 | 42,538 | 63,591 |
| February | 49,030 | 22,553 | 20,139 | 42,692 | 69,929 |
| March | 58,273 | 29,500 | 26,375 | 55,875 | 72,325 |
| April | 52,716 | 23,396 | 27,736 | 51,132 | 73,909 |
| May | 56,679 | 28,814 | 27,669 | 56,483 | 74,105 |
| June | 55,605 | 27,525 | 31,902 | 59,427 | 70,283 |
| July | 50,075 | 25,438 | 33,429 | 58,867 | 61,491 |
| August | 56,024 | 26,757 | 31,185 | 57,942 | 59,573 |
| September | 51,602 | 25,587 | 22,689 | 48,276 | 62,899 |
| October | 52,792 | 28,602 | 26,832 | 55,425 | 60,267 |
| November | 49,945 | 30,375 | 29,932 | 60,307 | 49,905 |
| December | 54,865 | 29,459 | 35,374 | 64,833 | 39,937 |
| Total, 1911 | 639,258 | 316,791 | 337,009 | 653,800 | — |
| January 1912 | 53,272 | 27,832 | 35,789 | 63,621 | 29,589 |
| February „ | 51,801 | 25,101 | 28,191 | 53,292 | 28,098 |

### Production of Gold in the Transvaal.

| | Rand | Elsewhere | Total | Value |
|---|---|---|---|---|
| | Oz. | Oz. | Oz. | £ |
| July 1911 | 679,881 | 29,377 | 709,258 | 3,012,738 |
| August | 682,405 | 31,002 | 713,407 | 3,030,360 |
| September | 669,773 | 30,852 | 700,625 | 2,976,065 |
| October | 677,923 | 30,721 | 708,644 | 3,010,130 |
| November | 291,466 | 28,267 | 719,729 | 3,057,213 |
| December | 680,782 | 29,126 | 709,908 | 3,015,499 |
| Totals, 1911 | 7,896,802 | 340,921 | 8,237,723 | 34,991,620 |
| January 1912 | 709,280 | 27,780 | 737,360 | 3,130,830 |
| February | 674,960 | 28,906 | 703,866 | 2,989,832 |

### Cost and Profit on the Rand.

| Month. | Tons | Yield per ton | Costs per ton | Profit per ton | Total profit |
|---|---|---|---|---|---|
| | | s. d. | s. d. | s. d. | £ |
| July 1911 | 2,095,220 | 27 2 | 17 10 | 9 4 | 969,687 |
| August | 2,107,809 | 26 8 | 17 9 | 8 11 | 967,457 |
| September | 2,037,329 | 27 4 | 18 1 | 9 4 | 952,665 |
| October | 2,083,900 | 27 0 | 18 0 | 9 1 | 948,278 |
| November | 2,089,387 | 27 6 | 18 3 | 9 3 | 965,729 |
| December | 2,030,439 | 27 11 | 18 4 | 9 7 | 967,897 |
| 1911 | 23,888,260 | 27 7 | 18 0 | 9 7 | 11,414,863 |
| January 1912 | 2,067,161 | 27 6 | 18 10 | 8 11 | 997,557 |

### Natives Employed in the Transvaal Mines.

| | Gold mines | Coal mines | Diamond mines | Total |
|---|---|---|---|---|
| January 31, 1911 | 183,268 | 8,357 | 9,991 | 201,616 |
| February 28 | 189,434 | 8,513 | 9,814 | 207,761 |
| March 31 | 193,457 | 8,493 | 10,061 | 212,011 |
| April 30 | 194,328 | 8,511 | 10,272 | 213,111 |
| May 31 | 190,392 | 8,379 | 10,425 | 209,196 |
| June 30 | 186,940 | 8,212 | 10,597 | 205,749 |
| July 31 | 181,582 | 8,122 | 11,054 | 200,758 |
| August 31 | 179,810 | 8,182 | 11,292 | 199,284 |
| September 30 | 179,619 | 8,045 | 11,475 | 199,139 |
| October 31 | 179,194 | 8,078 | 11,319 | 198,591 |
| November 30 | 176,736 | 8,043 | 10,071 | 194,850 |
| December 31 | 178,282 | 8,053 | 8,914 | 195,249 |
| January 31, 1912 | 184,046 | 7,805 | 9,524 | 201,375 |
| February 29 | 190,320 | 7,922 | 10,789 | 209,301 |

### Gold Output of India.

| Year 1910 | Year 1911 | Feb. 1912 | Year 1912 |
|---|---|---|---|
| £2,104,858 | £2,150,050 | £181,084 | £367,039 |

### Production of Gold in Rhodesia.

| Month. | 1908 | 1909 | 1910 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| January | 199,388 | 204,666 | 227,511 | 214,918 |
| February | 191,635 | 192,497 | 203,888 | — |
| March | 200,615 | 202,157 | 228,385 | — |
| April | 212,935 | 222,700 | 228,213 | — |
| May | 223,867 | 225,032 | 224,888 | — |
| June | 224,920 | 217,600 | 214,709 | — |
| July | 228,151 | 225,234 | 195,233 | — |
| August | 230,792 | 228,296 | 191,423 | — |
| September | 204,262 | 213,249 | 178,950 | — |
| October | 205,466 | 222,653 | 234,928 | — |
| November | 196,668 | 236,307 | 240,573 | — |
| December | 217,316 | 233,397 | 199,500 | — |
| Totals | 2,526,007 | 2,623,788 | 2,568,201 | — |

### Production of Gold in West Africa.

| Month. | 1910 | | 1911 | | 1912 | |
|---|---|---|---|---|---|---|
| | Oz. | Value | Oz. | Value | Oz. | Value |
| | | £ | | £ | | £ |
| January | 17,357 | 70,699 | 15,903 | 66,107 | 26,098 | 107,262 |
| February | 16,976 | 68,469 | 15,179 | 63,081 | — | — |
| March | 17,627 | 71,954 | 16,387 | 67,673 | — | — |
| April | 16,363 | 67,069 | 17,237 | 70,880 | — | — |
| May | 16,590 | 68,355 | 24,427 | 96,409 | — | — |
| June | 17,194 | 70,988 | 22,555 | 92,174 | — | — |
| July | 15,564 | 58,551 | 22,510 | 91,955 | — | — |
| August | 13,921 | 57,713 | 25,385 | 103,753 | — | — |
| September | 11,497 | 47,746 | 26,717 | 109,039 | — | — |
| October | 13,341 | 55,046 | 26,826 | 109,503 | — | — |
| November | 14,021 | 57,658 | 24,289 | 99,299 | — | — |
| December | 15,042 | 61,737 | 24,369 | 99,569 | — | — |
| | 185,493 | 755,985 | 261,784 | 1,069,442 | — | — |

### Production of Gold in Western Australia.

| Month. | Export oz. | Mint oz. | Total oz. | Total value |
|---|---|---|---|---|
| | | | | £ |
| Total, 1910 | 363,496 | 1,209,856 | 1,573,352 | 6,682,042 |
| Total, 1911 | 160,021 | 1,210,447 | 1,370,468 | 5,823,522 |
| January 1912 | 10,697 | 95,673 | 106,370 | 451,828 |
| February „ | 10,441 | 92,091 | 102,532 | 435,526 |

### Other Australasian Gold Production.

| | 1910 | 1911 | February 1912 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Queensland | 1,840,337 | 1,623,390 | *100,710 | 100,710 |
| New South Wales | 803,727 | 769,353 | 59,132 | 113,953 |
| New Zealand | 1,896,322 | 1,808,049 | 132,232 | 276,299 |
| Victoria | 2,422,700 | 2,138,000 | *142,903 | 142,903 |

* January figures only.

### Sale of Tin Concentrate at Redruth Ticketings.

| | Tons | Value | Average |
|---|---|---|---|
| Year 1911 | 6151¼ | £702,599 | £114 4 5 |
| January 8, 1912 | 253½ | £28,890 | £113 1 5 |
| January 23, „ | 216 | £25,122 | £116 6 2 |
| February 5, „ | 257¾ | £30,382 | £117 17 6 |
| February 19 „ | 245¾ | £29,879 | £121 11 8 |
| March 4, „ | 268¾ | £31,579 | £117 10 0 |

### Exports of Tin and Ore from Straits and Bolivia.
Reported by A. Strauss & Co.

| | 1911 tons | Feb. 1912 tons | 1912 tons |
|---|---|---|---|
| Metal from Straits to Europe and America | 55,135 | 5,295 | 9,313 |
| Metallic Content from Bolivia to Europe | 22,577 | 1,165 | 2,787 |

# REVIEW OF MINING

INTRODUCTORY. — It is remarkable that the mining markets have been so little affected by the coal strike. Nigerian tin shares have been the feature, many of these having doubled in price, some even have trebled, since the date of our last review. To the prospects of the field we have referred in another part of this issue and have here only to remark that the gamble proceeds merrily. New companies are being formed as out of nothing, and these with the fertility of germs are evacuating offspring long before they themselves appear mature. Caution, though for the sake of appearances formally invoked, has been thrown to the winds in the whirl of which many will be caught and stripped. We wish it were a case of only 'dog eat dog,' but know that cannot be; the public will be despoiled again. From this knowledge arises our regret that engineers can be found ever ready to do the will of the promoter, ever ready to assist in the spoilation. The tin industry itself in Nigeria is steadily progressing and considerable expansion will doubtless occur. Discoveries of tin lodes in more places than one have been announced, and it is primarily upon these that the shares have been boosted on the Stock Exchange.

Mexican shares have fallen appreciably upon news of further unrest, though Esperanzas have dropped a great deal on their own account. Kaffirs have maintained themselves well and, with the favourable labour returns now being received, it may be expected that the lowest level has been passed in this market. The Westralian market has been depressed and the gloom is not relieved by any prospect of revival. Waihi shares have also been a very poor market, consequent upon low assays upon the tenth level. A new Russian concern, the Russian Goldfields, has just been brought forward with a capital of £130,000, of which an amount of £30,000 will be offered to the public as 7% convertible cumulative preference shares. We hear that the amount of cash which will remain as working capital, after various payments are made, will be totally inadequate to put this large property on a dividend paying basis.

TRANSVAAL. — The final figures for the Witwatersrand in 1911 show that the tonnage crushed was increased by 11%, whereas the dividends paid were 12½ per cent. less. The January statistics as first announced gave 737,060 ounces of gold, worth £3,130,830, as the output for the month. This would have been a record, but a subsequent correction was made by the London secretary of the Transvaal Chamber of Mines, stating that the total included 19,764 oz. of gold reserves. Subtracting this the total became 717,296 oz. worth £3,048,266, which is the second largest output so far recorded. Information has now been cabled from Johannesburg to the effect that the government are about to bring in a law making it illegal for a company to declare a dividend when still in debt. This, it is understood, will not apply to debts such as debentures which are properly funded and the incidence of which is appreciated by the shareholders, but to those floating debts and overdrafts concerning which the shareholders are incompletely informed. Had such a law been in operation last year the East Rand would have been obliged to issue its debentures earlier, and should it become passed the Crown Mines may have to make such an issue. The returns which have so far been received for February are satisfactory. Though those of the Albu and Anglo-French groups are disappointing, those of the two Modderfonteins and Brakpan are good, as are also sev-

eral others. The labour returns are very satisfactory, the increase for February making with that for January a total of 13,420 boys as against 10,832 for the same two months of last year; the increase for last month alone was 7566.

In general the reports for the last quarter of 1911 as far as development is concerned were quite satisfactory, this being especially the case with several mines, among which Geduld must be mentioned. Simmer Deep developments were also very satisfactory in that more ore was developed than mined. The annual meetings of the Robinson group have taken place, at which the position of the Randfontein Central was presented as quite satisfactory. At this mine with a sufficient supply of labour assured they look forward to use the whole of their 1000 stamps next month and to pay dividends at the end of this year. The ore reserve at the end of last year was 5,658,859 tons of 7·29 dwt. assay-value, which does not appear large for a crushing capacity of 3,100,000 tons per year. There are, however, at Randfontein more reefs than one, and quite recently this company has absorbed the South Randfontein Deep where there is an unfinished shaft, which will doubtless be completed without delay. East Rand shares have been below £2½, but have since somewhat recovered. The shadow of further capital expenditure has been largely responsible for this position, though the report of the superintending engineer concerning the ore reserve was a depressing factor. In this connection it is important to know whether the 40,000 tons per claim, which the chairman gave at the annual meeting as the average yield of the claims exhausted, took into consideration the claims of unprofitable ore which will never be worked. If it did not, and that is evidently the case, then the figure of 40,000 is quite inapplicable to the area of the unworked claims which will doubtless contain unprofitable ore. This mine, however, in spite of a breakdown of the power plant in the last days of February which has not yet been repaired, declared a profit for February higher by £7500 than that for the previous month, this result being due to a larger yield per ton treated. One of the brightest reports was that of the Wolhuter which showed progress all round, though the official estimate that the mine had a probable life of about 10·7 years was perhaps a little disappointing. The Nigel has lately not been doing well, and from information officially cabled it does not appear that it will do better, three reasons being given, two of which are lower assay-values. Circulars have been issued stating the basis on which it is proposed that the Ferreira Deep will absorb the Ferreira. We think that this is a natural and proper course which must be to the benefit of the shareholders of both companies.

The Messina copper mine is being financed by the Camp Bird. More money is required for plant, etc. At the end of the year it was stated that the ore reserve consisted of 121,000 tons of developed and partly developed ore containing 10% of copper, 265,000 tons of probable ore, and 120,000 tons of possible ore. 'Probable ore' is defined as the assumed lateral and vertical extensions of the orebodies where exposed on one or two sides; 'possible ore' as the tonnage allowed for two additional levels below the eighth.

The output of tin concentrate in the Transvaal for the last half-year was 1473 tons as against 2076 tons for the previous half-year and 1765 tons before that. At Zaaiplaats and at Groenfontein less is being obtained, and in the future greater dependence will have to be put upon the alluvial deposits.

RHODESIA.—The January gold output was worth £214,918, which is somewhat less than last month but slightly higher than that for the corresponding month of last year. We hear that the assay-value of the ore in the bottom of the Globe & Phœnix is not so high as here-

tofore and that this is having a depressing effect. The Surprise, it is announced, is to be let on tribute, a disappointing termination of hopes which not so long ago were high. The report of Bucks Reef for the quarter ended December 31, 1911, showed a loss. The report of the Shamva Mines for the same quarter gave working expenditure £6667, capital expenditure £2671, and depreciation £6253. It is remarkable to see this latter item figuring so early in the life of a company. It is stated the agreement for the railway which will serve this mine has been signed and construction is proceeding, which must be good news for shareholders. The latest assays from the third level crosscuts were somewhat better. At the Shamva East some 5000 feet away they have the same formation which is described as an old indurated quartzite or grit containing angular or rounded pieces of older rocks. The consulting engineers who have lately examined the Eldorado have made encouraging reports; later cabled information is that the main reef has been struck on the 9th level assaying 12 dwt. over 60 inches. The British South Africa Company reports that its interest in many of the producing companies has been commuted for shares, and that in the majority of new companies the interest will be paid in royalties.

According to cabled information the lode in the Antelope mine was cut in a winze 100 ft. below the No. 8 level, with satisfactory gold content. Information has also been received that on the second level of the Eileen Alannah, 930 ft. east of the shaft, an ore-shoot has been struck giving assays of about 12 dwt. with a width of 6 ft. for a length of 25 ft. driven, and that there is good ore in the face. It is interesting to note that a special report upon the Rose of Sharon and Shamrock mine, not agreeing with the advices from the staff, has been referred back to the manager.

The Bwana M'Kubwa Copper company announces its decision to erect a plant on the spot to treat 75 tons per day of carbonate ore. Inquiries at the offices elicit no information as to the nature of this plant. The company also reports that at the 450-ft. level large bodies of sulphide ore have been found averaging 5% copper.

WEST AFRICA.—The lode in the lowest level of the Broomassie mine at 1170 feet is good. At the level above, the ore-shoot was 425 feet long, and 200 feet above that it was 126 feet. The battery has a capacity of about 3000 tons per month and the ore being crushed assays something over one ounce per ton. With the working cost, including redemption, at about 55s. per ton there is still some profit left. At the Tarquah during January 85 feet was driven in ore assaying 65s. 7d. over a width of 83 inches; the ore broken in development assayed 45s. 6d. At Abbosso during the same month the ore broken in development assayed 43s. 9d. The lower levels of the Abbontiakoon are stated to show a reef considerably wider than usual. The ore reserve now standing at 634,000 tons, little further development will now be done pending the completion of the reduction plant. Funds for this have been provided by the issue of 50,000 shares at par. The fact that these could be so issued must be taken as an expression of confidence in the mine. Reference is made elsewhere in this issue to the tin industry; the total reported output of concentrate for January was 204 tons.

The Ashanti Goldfields Corporation report that for the month of February, 11,772 tons of ore was treated and that 9281 oz. of gold of an estimated value of £39,429 was obtained. Further that with regard to the January output the estimated clear profit was £15,963. In explanation of this lower profit, it is stated that during January the cost of repairs to furnaces and to the plant generally were abnormal. We understand, however, that the mine is looking very well at the present.

AUSTRALASIA. — It is interesting to note in connection with the annual general meeting of the Broken Hill Proprietary that the directors in pursuance of their usual practice made an inspection of the mine. At the Waihi the assay values of the Martha lode on the tenth level have so far been low and the shares of this company have moved down in consequence. For the four weeks ended February 17, 26,789 tons was crushed yielding bullion to the value of £46,525. At the Grand Junction developments are favourable. The development now being done in the Golden Horse-Shoe from the shafts of the Great Boulder has exposed a good lode. A crosscut 80 ft. north of the main shaft of the latter property on the 2800-ft. level cut through the No. 4 lode of the former and exposed a width of 15 feet assaying 30 dwt. Similar results were obtained from boreholes, the total result of this work being to prove the lode on this level for a length of 460 feet. The crosscut from the main shaft on the 2650-ft. level showed this same lode to be there 7 feet wide and to assay 25 dwt. As this lode enters the Horse-Shoe ground at a depth of about 2600 feet, it is evident that a good deal of ore is now assured in the bottom of this mine though it cannot yet be reckoned in the ore reserve. It will be easily understood that the developments of the Great Boulder itself at its deepest level, the 2800-ft., are not encouraging. The ore reserve of this mine at the end of the year is given at 698,662 tons containing 508,712 oz. of gold or 14·56 dwt. per ton. Last year the figures were 760,000 tons with 570,821 oz. while, during the year, 187,510 tons were treated yielding 158,345 oz. The above ore reserve, with the large amount of liquid assets which the company possesses, will evidently allow the dividend to be maintained for some time to come, while further ore will doubtless be developed. Though the results in the bottom of the Kalgurli might be better, the upper levels continue to give encouragement; a borehole on the 200-ft. level gave 4 dwt. from 35 to 65 feet, and 46 dwt. from 158 to 163 feet. The quarterly report by the managers of the Great Boulder Perseverance is not cheerful. The Lake View lode on the 2200-ft. level is scarcely profitable. At this mine also they have to try again in the upper levels. The profit for the Ivanhoe for February is £18,100, which is low. At Mount Morgan there is a tendency for output and earnings to decrease, the latest dividend being met partly from the cash reserve. It is interesting to note that at this mine depreciation is regularly charged during the year at a fixed figure. Cable advices from the Talisman are that the assay-values in the winze about 230 ft. below level No. 13, are very satisfactory, while more than 1000 ft. of highly profitable ore has been proved on No. 14 level. The assay-values 70 ft. below the 100 ft. level at the Bullfinch Proprietary are good. The progress report of the Mount Lyell Mining & Railway Company, every two weeks, reads like that of an underground foreman to his boss.

We referred in our issue of last month to the absorption of the Einasleigh Copper mining company by the Chillagoe company. It is now announced that the latter company is about to call up the shilling liability on the 1,160,000 shares, in order to provide additional capital for various purposes. In the first place £10,000 has to be paid as part purchase price of the Einasleigh property, and further expenditure will be required in connection with the development of that mine; secondly the damage done by fire to the Chillagoe smelting plant has to be made good; and thirdly money is being spent in developing the Mount Mulligan coalfield and providing a railway thither.

INDIA.—On the 450-ft. level of the North Anantapur the lode still continues good, the average assay-value and width over a length of 31 ft. driven being 2 oz. and 5 ft. 6 in. re-

spectively. At the Jibutil mine of this same district there was a good shoot of ore on the 550-ft. level which has however now been passed through. The annual report of the Mysore gives the profit for 1911 to be £494,794, which is £2565 less than the previous year. The actual mining profit was greater but a larger amount £53,201 was paid in royalty. In spite of this, however, the dividend was increased by 5% to 120% for the year or a total of £366,000, this having been made possible by a smaller expenditure on plant and machinery. The cash reserve of this company now stands at £100,000, and the ore reserve being satisfactory the position of this mine is excellent. The Nundydroog also did extremely well during the same year; 952 tons more was crushed; 7587 tons more tailing was treated; the revenue on gold account was increased by £4494 and the profit by £15,189, the total of the latter after paying royalties being £180,785, of which £127,266 was distributed as dividend or 4s. 6d. per share. It is worthy of notice that the greater factor in securing this larger profit was a decrease of 3s. 2d. in the working cost, which, including an amount of 8s. 2d. for development, was 25s. 10d. per ton. The yield per ton was the same as last year.

CANADA.—The news from the Coniagas mine at Cobalt to the effect that the veins have been proved to continue downward into the Keewatin rocks will be comforting to those interested in the district. It has hitherto been supposed that the silver-bearing veins would not be generally found to continue downward from the diabase into the basement rock, and the rarity of the cases where they do has sufficed to establish the theory that such continuity was not to be expected. The new discovery has encouraged prospectors to go over the ground again. Mr. C. W. Knight, of the Geological Survey, has made an examination of the Coniagas and confirms the view that the rock below the diabase belongs to the Keewatin.

The Cobalt Townsite company has joined the ranks of dividend payers. This is one of the few mines at Cobalt that are owned in England.

The directors of the Tyee Copper company have decided to improve and extend their smelting plant at Ladysmith, Vancouver Island, and for that purpose have issued £50,000 6% debentures.

The report of P. A. Robbins, the manager of the Hollinger mine, reached us after we had gone to press in February. This is the most authentic bit of evidence hitherto available in regard to any mine at Porcupine. Mr. Robbins estimates that the ore assured amounts to 460,000 tons, having a gross value of $10,230,000, from which a profit of $7,550,000 will be gained. This is equivalent to £1,510,000, as against a market valuation of £1,300,000. Thus the return of capital is assured and the speculator will depend for his dividends on further discoveries of ore. These are likely, as the mine is young. The new mill is nearly completed. It is stated that a rich patch of high-grade ore has been struck on the top level of the Dome and that the 40-stamp mill is to start about the middle of March.

UNITED STATES.—The Camp Bird, in assisting in the issue of £250,000 of 6% debentures for the Messina mine in the Transvaal, confirms its existence as a finance corporation. The assistance consists in guaranteeing five years' interest on these debentures, for doing which it obtains an option over a large block of Messina shares. This debenture issue is offered in the first place to the Camp Bird stockholders. In a circular issued various particulars of the Messina mine are given. The ore mined to June 30, 1911, was 65,788 tons producing 9699 tons of concentrate assaying 53% copper. Mr. Calderwood, the consulting engineer, estimates that to the eighth level the ore developed and the probable ore make together 430,000 tons with an estimated profit

of £600,000. On this ore reserve, it is proposed to erect a smelting plant capable of beneficiating 120,000 tons per year, from which it is calculated a total profit of £150,000 will be obtained, or more than ten times that necessary for the debenture interest. Further details of the Messina mine are given under the heading of the Transvaal.

A summary of a report upon the property of the Frontenac Consolidated Mines has lately been widely circulated. This contains such a jumble of loose phraseology as to call for special comment. We are told " The *vein system* as a whole presents more than ordinarily interesting characteristics in that it consists of an *ore channel* of varying width, containing as a rule an *ore streak* of 3 to 5 feet wide on either wall. These streaks—known as the the Hanging and Footwall *Veins*—contain pay values in varying proportion, in many cases good *chutes* have been found to exist side by side. The coming together of both veins is always marked by greater enrichment and occasionally there is a joining *feeder* equally enriched between the two." In this quotation the italics are our own. Surely this could have been put more clearly. When we are ever pressing for exactitude in terms it comes as a shock to us to find such carelessness in the report of a reputable firm of mining engineers.

MEXICO.—At the Exploration company's meeting it was announced by Mr. R. T. Bayliss that the Buena Tierra mine, in the Santa Eulalia district of Chihuahua, was to be brought out as a subsidiary company. This was done on February 16. The capital is £330,000, of which £30,000 is working capital. Since May 1910, this mine has been tested thoroughly by the Mexican subsidiary of the Exploration Company, under the direction of Mr. R. M. Raymond and the superintendency of Mr. A. C. Brinker. Further particulars will be found under 'Company Reports.' On the same occasion the chairman referred to another Mexican subsidiary, the Santa Rosa mine in Zacatecas, which has been equipped with a complete reduction plant of 100 tons daily capacity. A profit of £40,000 per annum is estimated, and 60% of the shares is held by the parent company.

Among recent Anglo-American enterprises in Mexico is the Candelaria Land, Mining, & Power Co., with a London board on which we note the names of Mr. H. Collbran and Capt. F. B. Lawson. This company controls the Candelaria mine, a famous old property in Zacatecas. Denny Bros., of Mexico City, have reported favourably on the prospects and a cyanide plant has been added to the mill.

Mr. H. A. Titcomb's report on the Esperanza depressed the share-quotation. He estimates a profit of $542,500 from ore and $500,000 from the tailing-dump, making about £208,000, or 9s. per share. The upper workings he considers practically exhausted and the San Carlos discovery on the 11th level he regards as most encouraging, but not yet proved as a new or important orebody. We note that among the units employed in the report are the dollar, pound sterling, square metre, gramme, and dry metric ton. Again we repeat that in reports intended for British shareholders it is desirable to avoid the use of foreign weights and measures.

Since Mr. Titcomb's report, that of the staff for the year 1911 has been issued. In this the ore reserve, including development and probable ore, is given as 200,043 dry metric tons, and the net profit $638,837. To this must be added a further profit of $440,000 from the accumulated tailing, making a total profit of $1,078,887 or £221,083. Beyond this the cash and cash assets together total £145,808 after the deduction of all liabilities and dividends. No late news is to hand concerning the developments on the San Carlos vein.

The Lucky Tiger Combination since it has been on the London market has made several communications to the Press. One item re-

ported an assay of gold $40, and silver $1200, but as no width was given, the information is valueless. It was therefore more than futile to add, as was done, that the above figures represented £250 per ton.

SOUTH AMERICA.—It is announced that the Aroa copper mine in Venezuela has been successfully reopened, and that the syndicate having the matter in hand is intending to ask for public subscriptions in order to provide the necessary capital for extending the scale of operations. This mine was worked from 1866 to 1894 by the Quebrada company, one of the Matheson group, but in the latter year the workings collapsed and the property was abandoned.

The following information was communicated to the Press as pertaining to the prospects of the Brazilian Golden Hill: "At 312 feet a quartz leader was met. It is barely an inch in width and carries no values. There is now every indication that we are close upon the first reef." We think the shareholders should protest against the publication of such an item, which can but bring ridicule upon their property. It would have been better to wait till the first reef had been struck, which apparently they are still doing.

The annual report of the Colombian Mining and Exploration company stated that in their mine 109,000 tons of ore assaying 10 dwt. was now developed, this amount being continually increased. The tonnage crushed during the year by the present plant had yielded extractions of 59·7% and 18·7% respectively from the gold and silver contents, these figures having been increased during the last two months of the year, to 77·5% and 29·5% respectively. The consulting engineer, Mr. A. Wilkinson, recommends the erection of a new plant of 40 stamps, to crush and treat 6000 tons per month, when the working costs he estimates would be £1 per ton.

Mr. W. G. Perkins has gone to Famatina to report and advise upon a method to deal with the fine ore and fine dust there, which materials have in the past been rebellious to the methods adopted. In the meantime on this side a re-construction of the company is being arranged.

The laying of the track of the railway between Arica on the Chilean coast and La Paz in Bolivia was completed on the 4th inst., and the line should be ready for traffic in six months time. The railway is 275 miles long and in passing over the Andes rises to an elevation of 14,000 ft. above the sea. The new line will be of great benefit to the tin industry in the neighbourhood of La Paz and Oruro as it will afford a short cut to the seaboard, and avoid the roundabout and expensive routes to Mollendo in Peru and Antofagasta in Chile.

SIBERIA.—The Lena Goldfields has acquired additional territory in the Bodaibo district and has sent engineers to inspect placer ground in the Okhotsk region of Eastern Siberia. It is reported that an important discovery of platinum has been made on the Lenskoie property of the company. Mr. A. Adiassewich has returned from an inspection of the Lena country and reports finding profitable dredging ground on the Chara and Jiuya rivers, both tributaries of the Lena. The gravel is 21 ft. thick, lies on soft bedrock, and carries gold for its entire thickness.

IRON.—After ten years of failure, the Dunderland iron ore deposit in Norway is to be worked again. The new proposition involves the use of the Ullrich wet magnetic machine, and the owners of the patents, Krupps, of Essen, are backing their process by subscribing a large part of the new capital required. The English shareholders are being asked to submit to a drastic reduction of their nominal capital, and the debenture holders are to lose their cumulative rights. It is significant that Krupps have stipulated for a re-examination of the ore deposits as to quantity and suitability for the new process before putting up the capital and erecting the plant.

# EDITORIAL

WE have pleasure in announcing that the annual dinner of the old students of the Royal School of Mines will take place this year on Wednesday, June 12, at the Imperial College Union Club, Prince Consort Road, South Kensington. William Frecheville, A.R.S.M., will occupy the chair.

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REDUNDANCY of words and phrases is a fault in writing and speaking to which we have often drawn attention. An example is provided by that unnecessary expression 'throughout the civilized world.' In commenting upon the enormity of the latest suffragette outrage, the worthy magistrate said that "such conduct could not be allowed to continue in any civilized country of the world." The force of this statement would have been greater, and not less true, if the uncivilized world had been included. Such conduct there would certainly not be allowed.

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MANY thousands of circulars were recently sent out by the mines belonging to the Neumann group inviting the shareholders to empower the directors to alter, in the case of each separate company, a specified article of association by eliminating the word 'four' and substituting 'five.' Newspaper columns also were filled that holders of bearer shares might be cognizant of this projected alteration, and we ourselves received copies of the circular sent courteously to us in the interest of the mining public. Our comment thereon is that the circular as issued is senseless, and out of place in connection with anything but a missing-word competition. It is evident that the article of association should have been printed. A few lines more would have cost nothing, whereas we feel sure that inquiries from the befogged and offended shareholders will entail considerable correspondence and postage. That is how the money goes.

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WE have been informed that the Kolman's Kop Company, which has distinguished itself as a dividend-paying corporation, recovering diamonds in German South-west Africa, proposes this year to pass its dividend, chiefly in consequence of excessive taxation. Without going into the exact figures, it would appear that about 50 per cent. of the gross value is demanded by the government in one way or other, the largest item being the export tax of $33\frac{1}{3}$ per cent. The burden of this taxation lies in the fact that it is upon the gross value, an application which we thought had been relegated to the past by all progressive governments, in favour of taxation on net value or profit.

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WE have sympathy with every honest desire on the part of the colliers to better themselves. Manual work when well and cheerfully done entitles the doer to respectful acknowledgment from the community. Nor is it sufficient that this should stop at abstract resolutions; it should be rewarded by adequate payment. We believe, however, that the collier does receive adequate payment. The squalid way in which many of them live is not evidence to the contrary; it is rather the evidence of improvidence. This hardly needs to be argued. It can be seen. The collier in Germany under less favourable conditions lives more comfortably than his British confrere and looks a better man. We are convinced that within the present payment to our colliers there is much room for them to better themselves. A reasonable restraint upon their pleasures would still leave them with more recreation than falls to the lot of the average

man and give them the wherewithal to better observe those decencies of life and demeanour which are the best evidence of self-respect. Until therefore the collier sets about the betterment of his condition by making the best of what he now has, we see small hope that any increase of wages wrung from the community will help him.

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AT the end of last month a decision was rendered by the United States Circuit Court to the effect that the Butters filter does not infringe the Moore patents. This case was begun as far back as March 1908, by the Moore Filter Co. bringing action against the Tonopah-Belmont mine in Nevada on the ground that by using a Butters filter the mine was infringing the Moore patents. This action the Butters Filter Co. defended, in the interests of its customers, providing thereby a case which, on account of the widespread use of vacuum filters, has been watched with unusual interest. Since the above announcement was made we have heard that the Moore Filter company has given notice of appeal, and we shall therefore yet have to wait before a final decision will be reached. We trust that in the end neither equity nor legal right will be offended.

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A NEW EDITION of the 'Directory of Directors' is welcome in this the thirty-third year of its publication. As a book of reference we are glad to have it, but each time it appears we are reminded of our illusions and shattered ideals. We used to suppose that directors were trustees for shareholders, but this is contradicted by the fact that individuals nowadays accept so many directorships—with the fees attaching thereto—as to preclude the idea that they represent anyone but themselves. When a man like Mr. Edmund Davis is 34 times a director he may be hailed by the penny Press as a Napoleon of joint-stock finance, but he cannot be supposed, unless he be a superman, to give efficient administrative ability to nearly three dozen companies. No ordinary man can be a real director, that is, a trustworthy adviser and a faithful trustee, to more than ten or a dozen enterprises at the same time. There may be men of superhuman mental and physical vitality to whom a more complex sphere of activity is practicable, but we are inclined to doubt it. Therefore those who serve on two or three dozen boards are fairly open to criticism as assuming responsibility with levity. We are quite sure that no ordinary man can do well a dozen things at the same time. We hope the time may come when the occupation of a director will be recognized as an honourable profession, and that directorships will be held preferably by men having qualifications other than large share-holdings or fictitious prominence in other spheres.

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### Camborne Mining School.

It is with much regret that we hear Mr. W. Fischer Wilkinson has decided to resign the position as Principal of this school, a regret which we know will be shared by many. We hear further this step is being taken because of disagreement with the local governors as to the management of the school. The present scheme is this. There is a Board of Governors recruited partly from the neighbourhood, partly from London and the provincial centres. The meetings being held at Cornwall, those governors who reside at a distance rarely attend, and most decisions therefore rest with the local members. This is indeed so much more the case in that a committee, necessarily local, deals with points as they arrive, passing them on for the consideration of the Board, or suppressing them, as they think fit. This is not the circumstance that should surround and limit the action of a Principal. On the contrary, we consider the interests of the school would be best served by securing for him the status of a Governor, or by making him independent within the limits of the financial position. We

feel sure that such an added dignity for the Principal would not only imbue this position with the attraction necessary to command the highest class of personality, but concomitantly it would draw students to the school and raise its standard. We do not wish to detract from the many advantages which this school possesses above others ; the mines in the immediate neighbourhood ; the fact that a mine is worked by the school itself ; these are attractions in themselves ; but they would in no way make good the lack of a first-class man for Principal. It is not to be expected, however, that such a one would submit to a procedure which might prevent his recommendations, in case of difference of opinion, receiving the consideration of the full Board, a condition of affairs which virtually exists now. It must not be overlooked that the recommendations of mining engineers have considerable influence not only in sending students to the school but in securing the grants from the government. This favourable influence we think will undoubtedly be withdrawn if the idea prevails that the Principal under the present arrangements does not get the latitude which mining engineers generally will consider his position warrants. In the interests of all concerned and remembering the satisfaction with which the appointment of Mr. Wilkinson was hailed two years ago, we think an inquiry by the full Board of Governors into the reasons of his resignation is therefore desirable.

## Lime-Roasting.

The paper presented by Mr. C. O. Bannister at the February meeting of the Institution of Mining and Metallurgy gave the results of much careful experiment regarding the reactions between lead and lime compounds, and from the point of view of academic research the author deserves high praise. The investigations related to the chemistry of the Huntington-Heberlein process and of the modifications subsequently introduced by Carmichael & Bradford and by Savelsberg. As far as the present practice of metallurgy is concerned these processes are now mainly of historic interest, and it is here only necessary to remark that the presence of lime was found to accelerate the desulphurization of galena and incidentally to produce from the fine material a sinter suitable for blast-furnace requirements. When the process was introduced in the United States, metallurgists found that the results could be obtained without the use of lime, and the discoveries made there with silica and iron oxide put a new complexion on the underlying principle and made it possible to apply the idea to the sintering and part-roasting of fine copper ores. The subsequent researches and inventions of Austin, Peters, Hofman, Collins, Dwight, and Lloyd are well known to our readers. Owing to the rapid advance in practice which followed these, the conflicting opinions with regard to the original process have become dulled, and there has been a tendency to accept the scientific investigations and papers by Hofman as the last word in the discussion. Comforted by the results of successful practice the metallurgists may raise a doubt as to the practical value of Mr. Bannister's researches, but all will agree that the scientific and ultimate value of his work is indisputable. It is true that the conditions of laboratory investigation do not reproduce the hard facts of commercial practice. Nevertheless the scientist who has time and opportunity for conducting researches into the chemical changes intimately associated with metallurgical practice deserves the support of his professional brethren, who will undoubtedly sooner or later find application for the information he presents to them. Though Mr. Bannister has helped to clear up many doubtful points in connection with the reactions at comparatively low temperatures between galena and lime compounds, it is rather his methods of investigation and their further application that interest us. The careful use of the pyrometer and the deduction as

to the endothermic or exothermic reactions are obviously of value in deciding as to the actual chemical reactions taking place inside a metallurgical furnace. We consider that Mr. Bannister is only on the threshold of his work, and that eventually his methods will elucidate many problems which are now only in the region of surmise. The fire treatment of complex sulphides and of complex residues containing lead and zinc offer a wide field for this line of inquiry, for the problems involved have baffled many metallurgists. The unexpected difficulties encountered have led to many theories, prominent among which the formation of compound oxides of lead and zinc has been proffered as a tentative explanation of some of the reactions. Then again the functions of various substances as conveyors of elements or of hypothetical molecular compounds in connection with certain reactions, are at present little known and are in many cases based only on supposition. We believe that light will be thrown on these and other dark places of metallurgy and chemistry by the investigations set going by Mr. Bannister, and we look forward with more than ordinary interest to the results of his further researches.

## Encouragement.

The annual report of the Wolhuter company for the year ending October 31, 1911, together with the speech of the chairman at the general meeting, will afford much encouragement to those interested in the Transvaal. Progress is reported in every direction. Compared with the results of the previous year the total working profit of £172,163 was £50,000 better, this satisfactory result being consequent upon an increase of 40,000 tons in the tonnage crushed; an increase of 0·15 dwt. in the grade of the ore treated; an increase of 1·8% in the extraction; and, lastly upon a decrease of 10·7d. in the working cost. There is also every prospect that this all-round betterment of results will be maintained. The ore reserve upon which the immediate future so much depends was increased by 55,000 tons during the year, whilst the development work showed that the gold content of the reefs was perceptibly better than heretofore.

This mine, which has had a chequered career in the past, is now so palpably in good running order, that the chairman was able in his speech to make a careful statement as to the probable life. The total amount of ore yet to be expected from the remaining untouched area of the property was, at 40,000 tons per claim, based upon the experience of the past, whilst the rate of crushing was that of the present plant, 360,000 tons per year. At these figures the life would be 10·7 years, which the consulting engineer, Mr. S. C. Thomson, considers a fair estimate of the life. The dividend paid during the year was at the rate of 15% absorbing £129,000, and it is forecasted that for the present year 17½% may be paid. The investor has in these figures all the data to enable him to calculate whether the shares of this company have any attraction for him. We believe that, in addition to the satisfactory nature of the results reviewed, the completeness and honesty of the information relative to the future will be widely recognized.

## Native Labour in South Africa.

From the point of view of labour, Rhodesia may be divided into two parts: that south of the Zambesi where native labour is required though but little is found, and that to the north where these conditions are reversed. The administrators in the north have until now thought it better in the particular interests of their own territories, to cause one-half of the wages due to their natives working in the south, to be transmitted back for their benefit to the kraals through the government labour bureau, leaving only one-half to be paid in cash at the mines. The consequence has been that these natives, in the presence of others receiving at the same time full wages, and

never realizing completely the benefit of that half sent to their kraals, have become mistrustful, and Southern Rhodesia has therefore not had that complement of natives coming from the north that, considering the number available, there was reason to expect. We understand that the actual result of sending money in this manner back to the kraals has also not acted quite in the manner expected. Before the introduction of this system, commodities were cheap and money dear. With the influx of money, prices of commodities and labour have multiplied, to balance which no compensating factor has developed, no industry has arisen in the land. We hear now that it is considered better for all parties that this arrangement shall cease, and that the distribution of natives throughout Rhodesia shall in future be more free; from which course considerable relief to the present stringency in Southern Rhodesia is anticipated. In the Transvaal, also, the present regular return of the natives to the kraals is the primary reason of the high cost of labour, and this we think has too long been accepted as a fixed condition. In this case again, to bring the native back home and money with him has been the policy of the Portuguese government throughout, from whose territory so large a proportion of the mine workers is obtained. Contracts made with natives there have a maximum period of six months, whereby a continual return is ensured, to the great benefit of all recruiting agents. In consequence of this, and of the great competition for such labour, the latest recruiting charge is now about £7 per native for a contract of twelve months, instead of £2 or £3, as it was a few years ago.

With things at such a pass it seems time that some radically different plan to keep the mines supplied with unskilled labourers should be tried, and we hear the idea of giving them facilities to live their family life in the neighbourhood of their work is now receiving serious consideration. This would of course be tried first by giving the opportunity to the better men but, *faute de mieux*, it appears to us to be a reasonable and hopeful course.

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**Responsibility.**

We notice that in the South African Assembly a question was put, though not allowed, asking why it was that the late general manager, Mr. Sydney Penlerick, was the only person being prosecuted in the East Rand affair. The answer to this is that the government becomes directly concerned only when its mining regulations are broken. For the proper working of the mine within those regulations, and for the proper delivery of the required returns, the general manager is, before the government, the only person responsible. There is little reason to think that Mr. Penlerick will complain because of the actual prosecution, but it seems to us likely that an undue proportion of the whole responsibility may thereby become centred upon him, and in fairness an analysis of the position is therefore desirable. His responsibility was twofold, that to the government, for which he will shortly account, and that to the directors. It cannot be gathered that Mr. Penlerick failed in his reports to the latter. That a manipulation of the output occurred under their direction becomes therefore a charge against them, no portion of which they can level against him. Let us be quite clear. We do not wish to relieve Mr. Penlerick of any proper censure. We expect that the manager should not only report fully to his directors, but also that, rather than adopt any irregular course to their subsequent instruction, he should make an effective protest. Mr. Penlerick evidently considered his responsibility ended with his report to the directors, and there is no evidence that he demurred to the irregular course taken afterwards, though by the simple observance of the mining regulations concerning the declaration of outputs, he had a means at

hand to compel a halt. But if he did not rise to this higher conception of his position, he may at least claim that he fulfilled its narrower obligations, in reporting properly to the directors and in taking their instruction. So much can be said for him. But what is to be said of the directors, whose duty it was to report faithfully to the shareholders? If the returns of Mr. Penlerick to the government were false, the reports of the directors to the shareholders were not less so. More than that. There was no object in making false returns to the government except in so far as it would allow irregular returns to be made to the shareholders. In this sense Mr. Penlerick is being prosecuted for making returns which were falsified, primarily in order that an irregular policy adopted by the directors might be promulgated. To bring the responsibility home, we substitute for the directors the name of the chairman, Sir George Farrar. We are convinced that his was the dominating personality, and his the unyielding optimism which, ignoring facts, led to such a débâcle. Of this there is conclusive evidence. The reports issued every quarter give sufficient data concerning the results of development, that to anyone interested, the trend of future events may be reliably forecasted. Early last year Sir George Farrar, at a public meeting, told the shareholders that never had he been more satisfied with the mines, and yet for several quarters previously the footage sampled, in addition to being an unduly low percentage of the total development, showed also a low average assay-value over a stoping width. It would be unprofitable to pursue the subject further, but we anticipate that, from this striking example of the discredit which can result from the adoption of an irregular course, much good will eventually result. We are further of the opinion that this will be best brought about by causing the engineer to speak not only in technical reports, but also in language unmistakable at general meetings; and we therefore hope that the new superintending engineer of the East Rand Proprietary, Mr. Ross Skinner, will make this an essential part of his duty as a member of the Board.

## Unpayable Ore.

The latest statement issued from the office of the East Rand Proprietary fails to exhibit a grasp of the realities of mining. Indeed, no recognition of the basic facts underlying the exploitation of gold mines is possible so long as official documents are couched in an amateurish phraseology so well calculated to obscure the essential truth. We are told that the reserve of ore consists of 6,716,605 tons of "payable" ore, of the "value" of 6·9 pennyweights, and of 11,150,397 tons, of the average "value" of 2·6 pennyweights, "which represents the accumulation of low-grade ore." This "low-grade ore" is also described as "unpayable ore." Until the East Rand management, and other managements on the Rand, emerge finally from their atmosphere of make-believe, they are not likely to restore public confidence in their operations. Rock assaying 2·6 dwt. per ton at Johannesburg in 1912 has no 'value'; it is not ore, either 'low-grade' or 'unpayable'; it is 'waste.' The proper term to be used for such material is not unknown to the management, for mention is made of "the waste rock sorted out." That is the proper destiny of 2·6 dwt. rock; it should be 'sorted out' as early as possible; it should be avoided completely wherever practicable; it should be labelled 'waste'; it should not be included in the ore reserve; and it should not be used as a lure to the ignorant shareholder. At the present time the working cost at the East Rand is 20s. or 5 dwt. per ton. It is hoped to reduce the working cost to 17s. 6d., but this figure does not include all the expenses to be deducted from the yield before the real profit is ascertained; the total cost is fully 20% more, so that even a working

cost of 17s. 6d. means that 20s. per ton must be spent before a dividend is distributable. We see no reason for anticipating a decrease in the total cost of operations; the mill expense may be reduced but the expense underground is more likely to rise than to fall in the future. Thus rock from which 2·6 dwt. gold may be recovered can, under no conceivable combination of circumstances yield a penny of profit; nay, more, rock containing twice as much gold, 5·2 dwt. or 21s. per ton, is not likely to confer any financial benefit upon the shareholders of the East Rand Proprietary. We note that in future it is proposed "to eliminate as far as possible from mining operations, all ore of an unpayable grade." This sounds like Kindergarten advice to mining students instead of a momentous decision by the controllers of one of the biggest gold mines in the world. One effective way of fulfilling this laudable but lamentably belated policy is to define ore as rock from which metal can be extracted profitably, and to stop talking about "unpayable grade," about the "value" of valueless banket, and similar pseudo-technical rubbish. Correct terminology is more than a literary frill, it is the outward and visible sign of honest thought.

## Freiberg.

The president of the Anglo-American Club, of Freiberg, asks us to make it known that he is anxious to obtain the addresses of old graduates of the famous Saxon mining academy. We are glad to transmit this message to every corner of the mining world. With the secretary's letter we have received the latest report of the executive committee. The Club was founded in 1866 and was intended for Americans only, but Englishmen were made honorary members. The first president of the 'American Club,' as it was originally called, was Mr. Arnold Hague, still an honoured officer of the U.S. Geological Survey. The second president was the late William Pettee, formerly professor of mining in the University of Michigan. In 1877 the club underwent several changes, culminating in 1879, when a new constitution was framed and the name was changed to the 'Anglo-American Club.' This marks the spread of civilization. During the decade 1881–1891 the club did well, for is it not recorded that a billiard table was purchased and a piano was hired? In 1892 a disruption was threatened, but harmony was restored, and since then the club has had a quiet and prosperous career. At present the membership is 26. Students who are neither British nor American are now admitted as extraordinary members, provided they can speak English. Thus the club has advanced to a broad basis of fraternity. This is made clear by the roster of membership. Among honorary members we note the names of the late Thomas M. Drown, Clement Le Neve Foster, Richard P. Rothwell, and happily among the living Messrs. Edward D. Peters and Richard Beck. Among the former students of the academy are James Watt in 1786, John Henry Vivian in 1803, Hilary M. Bauerman in 1853, James D. Hague and Raphael Pumpelly in 1856, Louis Janin and his brother Henry Janin in 1857, Rossiter W. Raymond in 1860, W. S. Keyes and B. S. Lyman in 1861, Augustus J. Bowie and S. F. Emmons in 1864, Gardner F. Williams in 1866, and so to later days. The president of the club now is Mr. Rudolph A. H. Flügge, of Johannesburg, and the honorary secretary is Mr. R. A. Baring-Gould, of Surrey. A society called the 'Old Friebergers' was founded in London last year, with Mr. Edward Hooper as president, the object for which it was established being to constitute a centre and rallying point in this country for old students of the Academy. The first half-yearly dinner of the society is to be held in London on March 29. Evidently the Saxon alumni have every chance to co-operate and fraternize. We advise them to do so.

## Buena Tierra.

The discussion on the 'Finance of a Mine' first brought forward in our columns by a series of articles from Mr. M. H. Burnham is continued in this issue by contributions from Messrs. Morton Webber and Ross B. Hoffmann, two well-known American engineers. These contributions, added to those already received and to those which we may still expect, will give our readers many and diverse views for their guidance. There will be little question, however, that the careful study of actual cases where the terms of transfer are available, will provide more solid support for future procedure, and we are glad therefore of the opportunity to discuss an actual case such as is presented in the transfer of the Buena Tierra mine from the Exploration Company to a separate corporation.

In point of time, the first foundation for this transfer is a report dated December 30, 1911, by Mr. R. M. Raymond, who had for 18 months been directing the exploratory work underground. The mine is situated in the Santa Eulalia district, Chihuahua, Mexico, midway on a line of extensive north-south fissures and faults, upon which important mines have long been, and still are, working. It is stated further that during the period specified, 47,624 tons of ore had been shipped to the smelter, yielding a net return of $7·71, at a total cost of $3·89 per ton. Mr. Raymond also states that, with a monthly output of 4000 tons, the working cost would be less, allowing the profit to rise to $4·50 per ton, and that with the orebodies now disclosed, it is likely that such an output can be maintained for five years. These facts clearly state the economic situation. With regard to the geological position, it is stated that the ore is an argentiferous lead carbonate with excess of iron, in two thick beds of limestone, lying at low angles of inclination at different horizons; to this it may be added there is reason to expect an eventual greater vertical extension. In lateral extent the orebodies continue along the north-south fissures mentioned, and belong to a class of ore deposit usually characterized by marked irregularity in dimensions, so that it is dangerous to allow for extension beyond the working-faces. Further exploration is planned on both sides of the known orebodies, but neither the text of the report nor the study of the plans attached holds out any great expectations from such work, though it is stated that if at the same time work can be undertaken elsewhere there are good chances of rendering the mine productive for considerably more than the five years above mentioned. In greater depth, below the lower ore-horizon, some encouraging results have been obtained, and it is expected that the sulphide zone will be reached some 150 or 200 feet below the 7th or lowest level. In the absence of references to deep orebodies in neighbouring mines, the outlook in depth must be limited by evidence, which so far, though encouraging, is scanty. The plan and longitudinal section, accompanying the report, have no explanatory legend, and do not therefore afford so clear a picture of the workings as could be desired. Some areas have been worked out and others have been developed, but, though on the section different markings are given to different areas, no explanation is given. It must further be remarked that the section is dated October 1910. This report is addressed to Mr. R. T. Bayliss, who, in turn, presumably writing as a mining engineer, addresses himself in a statement dated January 23, to the secretary of the Exploration Company. In this statement, which expresses the opinions formed from a personal inspection, he adopts the figures of Mr. Raymond and, in agreement with other engineers mentioned, including Mr. A. C. Brinker, the actual manager of the mine, he estimates a monthly profit of $18,000 on an output of 4000 tons per month. He expresses the opinion that the mine is essentially one of

great promise. He believes "that further development within this area will disclose a very large tonnage of ore in addition to the 250,000 tons already exposed"; and with reference to the remaining and greater portion of the property he states his belief "that systematic development therein will greatly enhance the value and extend the life of the Buena Tierra mine." These opinions are more hopeful than any similar expressions in Mr. Raymond's report.

The next movement toward the transfer was made by Mr. Bayliss in a speech at the annual meeting of the Exploration Company held on February 13. On that occasion he said that as the prospectus of the new company would be based very largely upon his personal opinion of the property, he spoke "with a due sense of responsibility." In his judgment the 250,000 tons at present available for extraction would be but a small portion of the ore which the mine would ultimately produce; and, with regard to the profit, he indicated that this would be increased if the monthly output were raised to 4500 tons, as was expected. At the rate of 4000 tons, however, the profit would be £43,000 per year, so that shareholders were being recommended to take shares in a company which, in his judgment, would at least give them a return of 10% per annum, and if his expectations became realized, it would pay a good deal more. Mr. Bayliss spoke not only hopefully but optimistically. He would indeed appear to have left the report of Mr. Raymond considerably in the rear and to have taken his own stronger line. No one has a better right to do so. The long experience and honourable career of Mr. Bayliss are all the guarantee that can be required for fair dealing, combined with attractive chance. In reading through his speech we are infected with his cheerfulness and have little doubt that fortune will be kind to those who follow his recommendations. Since, however, Mr. Bayliss invited a study of the figures which he placed before his audience, we are compelled to become more calculating. A working profit of £43,000 per year would, if all distributed, allow a yearly dividend of about 13%. Invariably, however, there are deductions to be made, and it is likely that the figure of 10% mentioned by Mr. Bayliss will be that eventually realized. The present ore reserve will last five years, so that a yearly dividend of 10% for that time may be reckoned as assured. The present value of such a return is equal to about 40%, to which extent, therefore, the capital is assured. This leaves 60% of the capital as the appraisal of future possibilities, a proportion which, under ordinary leadership, would rob the recommendation of the greater part of its attractiveness. This is, of course, the cold matter-of-fact way of looking at business. The warmer and more sympathetic way is that taken in the prospectus, issued on February 16. In that it is estimated that the 250,000 tons will yield a profit of £231,000, from which it appears that 70% of the capital of the company is represented by the ore now exposed in the mine, regardless of further development, which is expected to ensure a productive life for many years. While we are among those who consider that optimism is necessary for any work of exploration, yet we demur to the above representation of 70% of the capital as assured. Since the capital is being called-up in full, at once, so the present value of the *quid pro quo* must be put forward, and not a total value spread over a series of years. On this basis of present value, the capital subscribed for the Buena Tierra mine will have 40% of its amount assured by the dividends which may be expected from the ore assured, leaving 60% at stake, or, in a broad spirit, the figures may be put at 50 and 50% respectively. We do not say that this appraisal of the future is necessarily excessive, but we do say that in the best interests of all concerned it should be clearly realized.

### State Mining Engineers.

The name of Mr. A. H. Ackermann has appeared so often in connection with reports upon private mining ventures in Rhodesia, that the fact is apt to be forgotten that this gentleman is engineer to the British South Africa Company, holding a position known more generally elsewhere as State Mining Engineer. We understand that the name of Mr. Ackermann is in such demand for reporting that it is no longer possible for him, work as hard as he will, and travel as fast as he may, to undertake every examination, the report of which will afterwards bear his signature. Much work therefore he has to leave unaided to his assistants.

Circumstances may alter cases, but we have the idea that the essential indebtedness which most countries owe to their State Engineers is for that portion of their work which has been matured in quietness, in the absence of rush. The collection of facts and data, their subsequent arrangement in place, and their final issue in well considered order and full of significance to a busy public, these appear to be to us the best service such an engineer can render to a State. Obviously Mr. Ackermann cannot render this service. The State whose paid servant he is, evidently considers its interests are best served when its engineer makes reports for private parties such as shall bring capital to the country, and if at the same time the fees received exceed the cost of the department, so much the better. Private mining engineers have, we consider, much ground for complaint in that the government places its mining department in competition with them, with such resources behind it as to make that competition oppressive and unfair. We can but think that with the inevitable aggrandisement of Rhodesia this sign of its more infant condition will be taken down.

In this connection we have noted also that the engineer of the Niger Company is in similar request, but investors should bear in mind that since the Niger Company is usually an interested party in any resultant transfer, a report by their engineer can hardly be disinterested, this remark applying also to the case of the engineer to the Chartered Company in Rhodesia.

### Tin Deposits in Northern Nigeria.

Nigerian tin has lately been the subject of so much discussion that some general remarks about these deposits and the economic conditions obtaining in connection with them will be opportune. Thirteen years ago Sir William Wallace, then Governor of Northern Nigeria, drew attention to the extended occurrence of tin ore in that country. In 1904, after nearly two years spent in prospecting, the Niger Company applied for two areas, the Naraguta and the Jos, both situated in the province of Bauchi. From these properties during the year 1906 133 tons of tin concentrate was shipped, and in 1907 a profit of some £7000 was made. Such was the beginning of the present industry, which during 1911 shipped some 1700 tons of tin concentrate. Though latterly this field has been brought into greater prominence because of the reported discovery of rich tin lodes, first attention is due to the detrital deposits upon which the immediate future of the industry depends. These are found near the head-waters of the streams which have their source upon the plateau of higher ground at Bauchi. Of this plateau, granite is the preponderating basement rock, and evidently at the same time the primary source of the tin ore. The distribution of this ore within that rock, where unaltered, would appear irregular, uncertain, and unprofitable, the general occurrence being that of small veins or stringers, without constancy of direction or composition. Decomposition of this rock by atmospheric agencies in the past has released an amount of tin and left it available for concentration by surface waters. Where these were sufficient to transport, clas-

sify, and re-deposit the detritus in proper bedded layers an 'alluvial' deposit was formed. In Nigeria such deposits are found in the river beds, and to a less extent in the banks on either side, these constituting the alluvial flats. But where in the absence of confinement to any channel the water was unable to move the tin, the lighter material alone would be transported, leaving the tin to settle upon the rock beneath, forming there an 'eluvial' or surface deposit. Such action would take place during downpours of rain and to a less extent during high winds in the dry season.

The importance of natural concentration is seen from the following considerations. Most metals have a wide distribution within the rocks of the earth's crust, but it is not often that this primary distribution can be worked as an ore. Some concentration of the valuable metal must generally take place to form any sort of ore deposit, whether lode or bed; and the greater the extent to which natural concentration is carried, the greater the value of the ore deposit, less work remaining for man to do. It will therefore be easily understood that the stream deposits in Northern Nigeria will be much more valuable than the surface deposits; but, as both classes are consecutive stages in the same process of concentration, the change from one to the other will be gradual. The bed of ore or 'wash' will be most pronounced in mid-stream and its metal content will there be highest, both factors diminishing on either hand till the stream deposit no longer exists, having given place to the more widely spread though poorer surface deposit. With alluvial deposits, the distribution of the mineral content has only in the most general way any relation to the distribution in the original rock, but with surface deposits this is otherwise. The concentration of these latter, involving no transport of the tin, has not eradicated the irregularity of primary distribution. Where the veins of tin in the original rock were so interlaced as to constitute a stockwork, the resultant surface deposit would be rich; but where, as would usually be the case, the veins were few and far between, a poor deposit would result. It follows therefore that surface deposits are most irregular.

It has been indicated that the tin deposits in Northern Nigeria are in greater part stream deposits, situated so near the rocky source of their contained tin that the two types occur quite close together. The topography of their situation is further such as to keep the rivers in their beds, giving them little opportunity to overflow their banks or to radically change their course. Where rivers are able to carry the mineral farther and deposit it on the flat land of a lower course, perhaps even taking it to the sea-board, then those larger and more extensive alluvial deposits are formed from which the greater portion of the world's alluvial tin and gold has been recovered. Such extensive deposits do not occur in Northern Nigeria. In general the deposits there, including the actual river beds, have a width varying from 20 to 100 yards. It is indeed a source of complaint that mining leases must have a minimum width of 400 yards across the bed. Length is measured along the stream. Depth, thickness, and value vary considerably, rocky bars and boulders, shallows and holes demand that for any approximate valuation pits must be sunk or holes drilled at regular and frequent intervals. The most profitable leases so far, the Naraguta and the Jos, have yielded respectively about 12 lb. and 8 lb. of tin concentrate per cubic yard, but these are exceptional returns and in each case the remaining material of that class will be exhausted in three or four years unless new deposits are proved. Between the areas of better value there are others whose mineral content is not sufficient to allow a profit under present conditions. It is reckoned at the Jos that it takes

about 4 lb. of tin concentrate to cover the working cost per cubic yard. The situation of those deposits however is not favourable for cheap working. They lie so low that in the wet season they are flooded, whereas in the dry season they have not water enough to sluice at full force; at all times also the material has to be lifted to be sluiced. At the Naraguta the workings are situated higher, so that they are able to use water not only for sluicing, but also to break the ground. Under these more favourable conditions they can even now treat at a profit some of the surface and stockwork deposit with a content of only 3 lb. per cubic yard. It will be realized from the foregoing that though in general the coming of the wet season is welcomed, it is not entirely an unmitigated blessing. It is the case with many properties that during the dry season they can hardly sluice at all, whereas during the wet season they are flooded out. The expansion of this industry beyond the richer portions will depend entirely on economic factors. Machinery will be necessary, dredges, hydraulic plants, etc., with all the necessary stores, including in most cases expensive fuel. At present the inclusive cost of transport from England is about £25 per ton. With the expected completion of the railway to Worno in April, this will be somewhat reduced, but in any case the change from calabashing by the natives to concentration by machinery means initial expense and not immediate profit. Every case will have to be most carefully studied before such a change is decided upon. It has generally been the experience with stream deposits that small syndicates do better than large companies. This need not be eternally the case, but it must not be overlooked.

With regard to labour there is shortness everywhere, but it is anticipated, as a further advantage is to be derived from the completion of the railway in April next, that 20,000 natives will then be released and become available for mining purposes. It would be too optimistic to expect that these would flock to the tinfield; it will rather be the case that the majority will return to their homes to enjoy a rest after this period of forced labour upon the railway, to which they went under pressure of their chiefs. Moreover the rainy season which will then be near at hand generally finds the natives engaged in agriculture, a seasonal employment of which the force has been well brought home in South Africa.

Reviewing the possibilities of the future in the light of the above considerations we are forced to agree with the statement in the last annual report of the Nigerian Government that "the stanniferous areas are undoubtedly valuable, but in several cases company promoters and others have expressed hopes which can never be fulfilled." We think that in many cases there will be a profit on ordinary working sufficient for an adequate return on the money actually spent upon machinery, stores, labour, and administration, and including a reasonable amount for property, but we feel sure that this profit will rarely be sufficient if the large amounts at which many properties have been entered are also included. With regard to the occurrence of tin lodes, several reputed discoveries have been announced, but not one has yet been shown beyond reasonable doubt to be valuable. We remember that at the time of the flotation of the Gel Tin & Alluvial Company, intending shareholders were advised that a large lode of high value had been shown to exist. We know now that this "valuable lode" contains more lead than tin and not enough of that metal to be of any value. Latterly the discovery of a very rich lode has been advised from Jemaa, but from the information yet to hand, it cannot be said that its existence as a valuable occurrence has been demonstrated beyond reasonable doubt. The geological circumstance of the occurrence of tin ore at

Bauchi is however such that we consider the eventual discovery of valuable lodes as not beyond the range of reasonable possibility.

### Anglo-Continental Meeting.

It is well to analyse the information given to the shareholders at this meeting concerning their Nigerian properties. In order to do this we will follow the chairman seriatim through his speech. The first reference was to the Gurum River property. It is estimated that from next June the shipments of tin concentrate will average at least 35 tons per month. The shareholders are left to infer that this output will be maintained. Seeing, however, that the promise of an output of 30 tons per month made many months ago is now being redeemed by something less than 10 tons, we are afraid that the latest promised output must be considerably discounted. It is further stated that two lodes have been discovered from which the assays so far made are low. We cannot agree with the chairman that this discovery is important. If substantiated it is interesting, but on the information afforded, it is worthless. Another feature stated to add considerably to the value of the property is the discovery of an old river bed "containing tin oxide of considerable richness." It is possible the intention was to say this bed contained a considerable amount of tin oxide. It is comparatively immaterial whether this tin oxide was of great purity; the important point to know is the amount of such tin oxide contained per cubic yard. That information was not given. It is also put forward as a further discovery that alluvial wash had been found in the southern portion of the property. The significance of this will appear from the following considerations. The property is stated to consist of 1311 acres held under three mining leases, and to include about 8 miles of the Gurum river. The average width of the property will therefore be about 450 yards, that is to say, it really only consists of eight miles of river bed. If then the discovery of wash at any point along this bed can be counted as a discovery, it is not only justifiable but proper to understand that there are extensive gaps between the valuable portions and that the profitable life is correspondingly shortened. It is to be hoped that the circular about to be issued will not only be found extremely interesting, as the chairman indicated, but will contain such information as may allow a correct idea of the value of the property to be obtained.

The next property mentioned is the Naraguta Extended, consisting of 2240 acres, or eight miles of river bed below the Naraguta. From this property also, nine months ago, an output of 30 tons per month was promised, whereas an average of 10 tons is now being obtained. To sustain the shareholders at this meeting, the chairman, however, could only repeat the statement by the manager in October last that "in the next rainy season he saw no reason why the output should be behind that of the Naraguta mine." Has nothing been done since last October? Has not the manager since then given any positive estimate of the probable output, instead of such an unsatisfactory negative and indirect statement as that repeated by the chairman? In the absence of such information we see good reason that the output of this property will not approach that of the Naraguta during the coming rainy season. It is further counted as a distinguishing and valuable feature of this property that loose stones found in a surface deposit "contain elvan," or as the chairman later more simply put it, "the surface deposit containing the elvans." This is a case of stones containing the mass of rock from which they sprang, the less containing the greater. Has ever a chairman done so much for shareholders? If the stones had contained diamonds, more could hardly have been made of it. Yet there is nothing valuable in the association, however interesting it may otherwise be. 'Elvan' is the name given in Cornwall

to a variety of rock known more generally as quartz-porphyry, and dikes of such rock are known as 'elvans.' They are found practically with every occurrence of granite, and it would be strange if they had not been found in the tin area at Bauchi. Be that as it may, samples of this rock were submitted to experts who spoke highly of its character. It would have been more to the point if the chairman's speech had been so submitted. Before leaving this property, we remark that, among others, one lode discovered was over 2 ft. wide and averaged 6% of tin. We think that shareholders should not allow such a valuable lode to remain unworked or to disappear.

The third property mentioned is the Gurum Extended; our readers will probably consider the views expressed at this meeting have equal right with the properties to be designated 'extended.' This property includes about 10 miles along the Gurum river, at one point along which a mining lease of 500 acres has been obtained in order that the production of tin may proceed whilst the remainder of the area under prospecting license is being prospected. From this grant of 500 acres, which doubtless represents a selected area, 427 acres were found to contain alluvial ground with an average thickness of 9 ft. said to be profitable throughout. It is stated that the mineral content of this deposit did not fall below 3 lb. per cubic yard, and that in some places it was as high as 35 lb., but these figures are quite insufficient as a basis for valuation. We should regard the wash containing only 3 lb. per cubic yard as valueless under the conditions existing at present in Northern Nigeria, or likely to exist there in the immediate future; so that though the manager states that when sluicing operations begin there should be an average monthly output of not less than 45 tons of concentrate, we cannot, on the figures given, share any hope that these figures will be maintained or that an adequate profit will result. We think the chairman himself must be somewhat doubtful on this point, as he brings forward a discovery of the mineral monazite in support of the position. It is true that so far this mineral has only been a source of trouble, lowering the market value of the concentrate, and that the quantity in which it occurs is not known nor the value it possesses; but this lack of information does not worry the chairman, who sees only that this discovery portends an increase in the value of the property.

Lastly we come to the Jemaa property, where, in addition to alluvial deposits, a tin-bearing lode has been discovered. It is stated that at the place where work was first done this lode was only 4 feet wide, and that a fair sample taken right across the outcrop assayed only 1% of tin. No other 'fair' sample is mentioned anywhere throughout the speech we are analysing, and it therefore appears hard that an attempt is made to invalidate even this one by saying that the low percentage would of course be due to severe weathering. It is common knowledge, however, that tin-stone is one of the most resistant of all minerals and that in consequence the weathering of a tin lode produces by the removal of the less resistant and lighter material an enrichment and not an impoverishment at the surface. This lode where it crossed the Jemaa river is stated to have a width of 75 feet, which at the Darora creek increases to 100 feet. At this latter place however it was seen to be lying so flat that the manager was of opinion that the width "might not be less than about 20 feet." Evidently he thought it really was less, though there was a bare chance it might not be. Later the shareholders were informed that five miles of such an outcrop existed, and that the lode had every appearance of being permanent in depth. From the figures given, however, it does not appear that this lode will ever get down into depth. At the Darora creek the outcrop width was 100 feet, though the true width might not be

less than 20 feet. If we take it to be 20 feet, the angle at which the reef dips may be calculated to be about 11° 30′ from the horizontal. If this be so, and this figure is the only one that can be logically deduced from those given, it will be seen that the lode lies very much like an alluvial deposit. Leaving, however, this interesting speculation as to its real character, we proceed to review the other data. It is stated that the lode has been cut in a shaft, where its width was shown to be 30 feet, the mineral being evenly distributed throughout the mass. Here the average assays are stated to give 25% of tin, a value which most will take as having relation to the whole width of 30 ft., though this is not definitely stated. It may, however, only apply to the mineral, which though evenly distributed, need not necessarily occupy the entire width. Until these points are cleared it is waste of time to endeavour to weigh the importance of the statement that the rich ore can be traced for a distance of 500 yards, or that it has been found in five costeens where the average value was 24%. The chairman in an ostentatiously frank manner stated that the information was at present incomplete, and, upon our subsequent visit to the office, the clerks, doubtless upon instructions, had the same answer ready for inquirers. But why were no pertinent questions sent by cable and definite answers received in time for the meeting? The excuse of incompleteness of information cannot be accepted. In order to emphasize again the necessity that this speech of the chairman should have been submitted to an expert even if only that it might have been edited, we call attention to the fact that the assays are stated to be 25% of tin per 2240 lb. Evidently the chairman was under the impression that the percentage might have been less if the short ton of 2000 lb. had been used. After hinting that a comparison with any other mine, no matter where, would be too exciting a calculation to be made in public, he advises shareholders to do it for themselves and dismisses them with an exhortation to be moderate. The seed was knowingly sown, and the result as indicated by the market value of the shares today must exceed his highest expectations. Mr. Oliver Wethered then continued in similar strain, reminding the shareholders that they were men of the world and not children, and as such should face the comparison, which the chairman shirked. At this point he expressed a desire to go to the Stock Exchange, this playful move on his part exposing to our mind the close connection of the whole business with market operations. Returning however to the comparison. First old Dolcoath was brought out only to be ruthlessly cast aside, supposedly unable to stand; then the Straits mines were hurriedly brought forward only in their turn to be shut down without hesitation. But what is the real position? It is that no comparison is possible between a mine which has produced so long and so well as Dolcoath and a prospect from which only a few indefinite samples have been taken. We are surprised also that Mr. Wethered should have stated that Dolcoath made its profits last year on ore which had a content of under 2 per cent. This percentage was the amount recovered; the original content of the ore would be about 3 per cent, a figure which has been the average for many hundred thousands of tons from this mine, amongst which many bunches must have assayed not less than 30 per cent. of metallic tin. And then as to the Straits. Excluding Banka and Billiton, the area over which profitable tin has been found in that country will be many times greater than that in Nigeria, and in addition labour is unquestionably cheap in the East and water abundant. Nigeria suffers in comparison. Finally though we sympathize with the undoubted prospects of this country, we quarrel with the way the budding industry is being made subservient to market operations. It will never bear the burden.

# SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

## CAMBORNE.

**The Condurrow - Grenville Amalgamation.** — Toward the close of last year, when Condurrow had exhausted its issued capital, £3000 was borrowed from Grenville on the security of the plant and property. Though no doubt the security is ample, particularly as it is backed by the personal guarantee of the Condurrow directors, yet I question the wisdom of a mining company lending part of its limited resources in such a way; unless, of course, the directors of Grenville had authority to absorb Condurrow, and were merely taking the first step to put such a plan into effect. No doubt the Grenville board had this in mind in making the loan. When however the scheme for amalgamation was laid before the shareholders of both companies, they were not enamoured with the idea, or the terms proposed, and the matter was referred back for further consideration. I consider the Grenville shareholders who opposed the scheme were absolutely justified, for never in my long experience have I known so little information given when an amalgamation was proposed. The shareholders were informed by circular that £54,000 had already been expended on Condurrow, that the mine was on the eve of making profitable returns, and that it was proposed to give £21,407 for the property, payable in shares, for which purpose Grenville would have to make a new issue of 50,000 shares, making the capital of the latter company £125,000. No report on the property by an engineer accompanied this circular, no plan was issued showing the relative position of Condurrow and Grenville, and in fact no information was afforded to enable the shareholders to decide for themselves the prospects of success. They were simply invited to send their proxies to the directors to be used in favour of the scheme. Those shareholders who attended the meeting were given a little information of a vague character, but nothing was said of the anticipated cost of draining and equipping the mine to the bottom, of clearing the old levels, and of developing the property in the direction of the great cross-course. In the absence of this information, it is difficult to understand how the Gren-

*GOULD'S ENGINE, WHEAL GRENVILLE.*

ville directors could have expected any other result than to have the scheme referred back. No doubt Condurrow is a promising property, but it will probably require a fairly large sum to bring it to the profitable stage, and Grenville shareholders were quite justified in looking askance at having this dead weight put round their necks. Although Grenville is making profits at the rate of £1800 per month, it would only require a drop in the price of black tin to £100 per ton to make a considerable difference, and then, instead of being able to develop Condurrow out of profits, the reserve capital would have to be called up, while dividends would in either case be out of the question for some time to come. For Grenville to subscribe some thousands towards financing Condurrow might not be unreasonable, but an amalgamation at present would be folly.

**London Control of Cornish Mines.**—At a meeting of Cornish shareholders to protest against the Grenville-Condurrow amalgamation, one or two of the speakers enlarged on the evils of London control and on the wicked waste involved by a London Office. This is typical of a certain class of Cornish mine adventurer; he imagines that only Cornishmen can effectively control and direct a Cornish mine, whereas the truth is that often a company is the better for the co-operation of outsiders, who are more often than not successful business men and largely interested financially, men who have no 'axes to grind,' no supplies to sell, but who are keenly anxious to do the best for the concern. To some people in Cornwall, the London investor is simply the 'greenhorn' to supply the funds to work properties for the benefit of the locality; he should have no voice in the disposal of the funds he supplies, nor in the management. The sooner these good people realize their mistake, the sooner will there be a prospect of a revival in Cornish mining. In the case of Grenville, the London directors are by far the largest shareholders, and the majority of the shares are held outside the county, and therefore there is good reason for a London office being maintained and for the control being in that great financial centre. Carn Brea is a recent good example of going outside the county for a manager, and I believe the addition of London business men to the directorate of some of our mines would be a step in the right direction.

**Parka Tin Mines.**—A company has recently been registered to work this property, formerly known as 'Park of Mines' and situated in the St. Columb district, the principal vendor being J. B. Reynolds, formerly connected with West Kitty. The proposition is quite a shallow one, the deepest point being 40 fm. below adit, and yet from 1873 to 1879, over 550 tons of high quality black tin was produced. The nominal capital of the company is £40,000, but an issue of 3000 6% mortgage debentures of £5 each is to be made to provide the necessary working capital. This is a new way in Cornwall of raising money to re-open an old mine, although, of course, there have been many cases of debentures taken up on the security of the machinery and plant. The debentures of this company are convertible into shares at the option of the holder, and the reason given for issuing them in preference to shares is that investors may receive interest on their money during the period of development, at the same time having the security of a first charge on the property and assets. W. H. Goodchild is the consulting engineer.

**Dolcoath.**—Elsewhere in this issue is given a summary of the report and accounts for the six months ended December 31 last, and it will be noted with satisfaction that the gross profit was £35,581, while for the whole year of 1911 it amounted to £71,952, the second best showing in this respect in the company's history. For the half-year in question, the gross profit equals 15s. 4d. per ton broken, or 2s. 8d. less than for the previous six months. This reduction is chiefly accounted for by a drop of about 6 lb. in the produce to 41·23 lb. per ton, although this was largely offset by a reduction in the working cost of 4s. 5d. per ton, owing to an increase in the output of 6028 tons. This decrease of 4s. 5d. is made up by reductions of 2s. 4d. per ton in wages, 10d. in materials, 7d. in general and administration expenses, and 6d. in royalties. It would of course be more useful to know whether an all-round reduction has been made in the stoping, development, and treatment departments, but as the company issues no analysis on these lines, and is in this respect quite behind the times, it is impossible to give this information. At the meeting, the chairman referred to the fact that over 15½ miles (or 13,669 fathoms) of development had been carried out since the company commenced operations in 1895; on the quantity milled, 1,481,495 tons, during this period, the ratio appears to have been 1 foot for every 18 tons handled. For the past six months the ratio was 1 to 22. It is satisfactory to hear from Mr. R. Arthur Thomas, the manager, that a

further decrease in the operating cost may be expected, and also that the efficiency of the new pumping plant at Williams shaft guaranteed by the makers is likely to be obtained. What is wanted now is another improvement in the bottom, and seeing that a new 20-drill compressor has been ordered to enable a more vigorous policy of development to be undertaken, I shall be surprised if some new ground of more than average value is not discovered within the current year.

**Carn Brea & Tincroft.**—The report of this company for the six months ended December 31 last shows clearly that at last a 'live' man is in control of operations, and that the whole affair is being regarded and conducted as a business proposition. What a comparison with former times when the meetings were despondent affairs, and only served to advertise to outsiders the inertia which had come over those who were then in control! Mr. E. S. King's speech to the shareholders, given elsewhere in this issue, was a distinct change from the type of remarks one usually gets from a Cornish mine manager, for he not only exhaustively dealt with matters which closely concerned the shareholders, but he touched on such subjects as Cornish metallurgy, working costs, and his new setting system, all of which are interesting to the county as a whole. This policy of speaking frankly on such matters must surely be regarded as a step in the right direction, and will, I hope, do much to break down the reticence of the average manager and lead him to consider the value of conferences on subjects of mutual interest.

During the six months, 41,670 tons of stuff was crushed producing 440 tons of black tin, or an average recovery of 23·64 lb. per ton. The total receipts amounted to £51,885, or 24s. 10d. per ton milled, while the working cost exclusive of 5·29d. per ton for capital expenditure, was £47,505, or 22s. 4d. per ton, showing thus a profit of 2s. 6d. per ton, or £5238 for the six months. The future of Carn Brea depends on vigorous development, and with this excellent price for tin, now is the time to do it. I notice the cost per ton for development was only 1s. 10d., so even if the footage was doubled, the mine would still show a decent profit, should the conditions ruling last half-year be maintained.

At last we have an intelligible analysis of working costs and I hope the other large mines will follow suit. In the table on the following column I give the more important figures contained in the analysis:

| | Per Ton Milled | | | |
|---|---|---|---|---|
| Mining | s. | d. | s. | d. |
| Breaking Ore | 6 | 11·59 | | |
| Trucking and Raising Ore | 1 | 8·59 | | |
| | | | 8 | 8·18 |
| Treatment | | | | |
| Rock Breaking | 0 | 5·02 | | |
| Ore Transport | 0 | 8·17 | | |
| Milling | 2 | 0·18 | | |
| Concentrating | 1 | 4·04 | | |
| Roasting | 0 | 3·11 | | |
| Dressing | 1 | 3·53 | | |
| Fine Grinding Concentrate | 0 | 1·69 | | |
| Magnetic Separator | 0 | 1·91 | | |
| Disposal of Residue | 0 | 0·62 | | |
| | | | 6 | 4·27 |
| Re-treatment | | | 0 | 6·47 |
| Pumping | | | 2 | 7·95 |
| General Charges | | | 1 | 4·08 |
| Development | | | 1 | 10·5 |
| Royalties | | | 0 | 10·86 |
| | | | 22 | 4·31 |

**Closing of Chyandour Smelter.**—I regret to have to record the intention of the Bolithos to suspend smelting at the end of June. The ostensible reason is that the lease of the land expires on that date. The plant is in the suburbs of Penzance and there may therefore be good reason for wishing it moved.

## JOHANNESBURG.

**Ancient Mine Workings** in the Transvaal was the subject of a paper read by T. G. Trevor at the January meeting of the Chemical, Metallurgical, and Mining Society. The paper formed quite an interesting study, with its touch of antiquarianism. The extent to which mining was conducted by the ancients in the Transvaal comes as a surprise to most people, and when it is considered that such mines as the Messina copper mine and the Rooiberg tin mine have developed from old workings, the great importance of giving careful attention to such occurrences becomes apparent. Whether old workings are being examined, or a newly-discovered orebody is being prospected, there is always some difficulty in following the oxidized lode near the surface. This point was fully emphasized by Mr. Trevor, and it is a most important one. Many properties have been condemned on the evidence of prospectors who have proceeded with their work in the wrong way. As Mr. Trevor says, "the only satisfactory way to re-open these workings is to bottom the 'made' ground, then to follow the foot-wall till the 'reef' or fissure, or, failing that, the lowest point of the 'made' ground is reached, and then to drive along the ancient face till the whole lowest face is exposed and the shoot found." Apart from their economic aspect, the ancient workings are instructive from a

historical point of view. Sufficient evidence is not yet to hand to warrant any theories as to who the ancient people were that mined for copper, tin, and gold on such an extensive scale both in Rhodesia and the Transvaal. It is at present presumed, however, that these ancient people came from southern Arabia. Whether this is so or not, they certainly knew something of the metallurgy of tin, bronze, and copper, in addition to that of gold.

**The Shortage of Native Labour** on the mines of the Rand was clearly reviewed by J. W. S. Langerman in his speech at the recent annual meeting of shareholders of the Randfontein Estates Gold Mining company. Mr. Langerman suggested that the government, as the largest shareholder in the mines, should be asked to convene a conference of the representatives of the various groups to discuss the matter, which is one of paramount importance not only to the industry but to the country generally. To quote Mr. Langerman, "on the Witwatersrand sixty-one mines are producing gold and of these thirty-nine were able to pay dividends for the year 1911. It may be taken for granted that most of the non-dividend-paying companies would have been able to pay dividends and the dividend-paying companies to pay increased dividends, if the disabilities placed on them by the shortage of labour had not existed." Undoubtedly, owing to the shortage of native labour, the working costs have increased and the average value of the ore milled has decreased, but the statement that most of the non-dividend-paying companies would have been able to pay dividends is hardly correct. It would be more nearly so if the word 'some' had been substituted for 'most.' In many cases no dividends are paid because of the low content of the ore worked, over-capitalization, or bad management. Again it was stated "that the complement of natives required for the full and efficient working of the gold, diamond, and coal mines associated with the Witwatersrand was in round figures 297,000, and that the supply amounted to 195,000, a shortage of 102,000 natives, equal to 34½ per cent." The figures 297,000 can be taken as greatly in excess of the number of natives that are actually required "for the full and efficient working" of the mines. The very reason that there is a shortage of native labour accounts for this. Each mine, being more or less short of natives, and anxious if possible to have too many rather than too few, puts its claims forward, based on a larger tonnage of ore to be mined and of waste to be sorted out, in such a way as to support its claims for as many natives as possible. In fact some of the older mines on the Rand are shown as requiring a larger complement of natives than they could accommodate. The heads of the various groups may know this fact well enough, but it is not to their benefit to cut down their figures. Mr. Langerman also referred in the following words to a proposal for co-operative recruitment under single control, whereby a cheapening of the cost of labour to the mines may result. "Such a scheme might possibly be the means of effecting a slight reduction in the expenditure, which is now incurred by the separate labour organizations, but it certainly possesses no advantages over the present methods of recruitment." Here Mr. Langerman was speaking purely as chairman of the Robinson group, which does its own recruiting, and apparently is doing comparatively well in obtaining natives. It is this kind of spirit which is militating against a combined effort by all the groups to devise a sound scheme for the recruitment of native labour. The government may convene a conference of group representatives, but no benefits are likely to accrue unless the heads of all the groups will pull together to improve the present state of affairs in respect to native labour.

**Breaking Ground.**—The Mines Trials Committee was persuaded by mining representatives of the various groups to experimen with explosives, with the view to decrease th waste of explosives at present prevalent i the mines. There is of course no standar by means of which the exact quantity of e plosive actually used can be compared to t theoretical quantity which should be used, b it is certain that the old conservative meth employed underground for the breaking f ground do give rise to an enormous waste f explosive, and any experiments in this dir tion have a wider field for investigation an any other branch of mining. The Mines Tals Committee soon discovered this, and th ugh unfortunately the results of the experin nts carried out for them by R. Allen at the Rin-son Deep are more or less inconclusive hey were interesting as far as they went. In eak-ing ground, there is always the one unlown factor, that is, the nature of the rock, hich makes it impossible to rely on mathem cally exact methods to determine the positio f the holes drilled or the quantity of explosi to be used. Practical experience is alone f any use in this respect. This being so, e only way by means of which economy ca be effected on a large scale in breaking ound si

in improved methods of drilling, whereby a much greater speed may be obtained, or an entirely new method of placing the holes made possible. Before great economies can be effected in breaking ground, mining men, it would appear, will have to wait for metallurgists to discover a metal harder than the quartz, so that electrically driven rotary drills may be used. As to minor economies in the use of explosives, Mr. Allen, as the result of his experiments, came to the following conclusions regarding development work: (1) It is impossible to devise charging formulas that would be of any practical general use for this work, but he considered that a general saving of explosive per foot of advance can be made by: (*a*) paying more attention than is usual to the charging and tamping of holes; (*b*) by always removing the paper ends of the cartridges so that the explosive is in continuous contact, without air voids in the charge; (*c*) by using a tamping rod of hard wood, of as large a diameter as possible, to fit the hole; (*d*) by keeping the charging end of the tamping rod always flat by frequent cutting off; (*e*) by using sufficient clay in tamping each hole, never less than 15 in. in depth; (*f*) by using small machines wherever possible when: (*1*) the holes can be drilled in more desirable positions for effecting blasting than is possible with large machines; (*2*) the holes being smaller in diameter, they can be charged more tightly and a more economical use of the explosives is made; (*3*) by drilling the holes on such a system that the burdens on the different holes can be equalized with more exactitude than is possible with ordinary work. The same remarks apply to stoping.

**Phthisis Commission.** — Although the officially authorized report of the phthisis commission has not yet been published, an unofficial statement has appeared in the local papers which may be taken to be substantially correct. It appears that about 3000 men, engaged on various classes of work underground in the Transvaal, have been examined; with startling results. About 30% of these men were found to be suffering from miner's phthisis. Of all classes of labour underground machine-men suffer most, as might be expected. The figures already published in regard to men who have worked on machine-drills are as follows:

*REINFORCED CONCRETE VAT IN COURSE OF CONSTRUCTION.*

| Period of work | Percentage having contracted miner's phthisis |
|---|---|
| After 6 months | 1½ |
| „ 2½ years | 25 |
| „ 3½ „ | 40 |
| „ 4½ „ | 55 |
| „ 5½ „ | 64 |
| „ 6½ „ | 70 |
| „ 10½ „ | 80 |
| „ 13½ „ | 90 |
| „ 15½ „ | 100 |

The disease is by no means confined to machine-men, although the figures given for other classes of labour are fortunately not so bad. For hammer-men the figures are:

| Period of work | Percentage having contracted miner's phthisis |
|---|---|
| After 2½ years | 20 |
| „ 5½ „ | 30 |
| „ 9½ „ | 40 |
| „ 15½ „ | 50 |

No class of underground labour was found to be free. The percentage of men having contracted the disease was found to vary from mine to mine, depending chiefly on the number of machine-drills in use. These figures disclose facts of a most serious nature. If these are the figures for the white labour what must be the figures relating to the native labour? 'Ghastly' is the only expression for it. Take the case of machine-boys. The rate at which they contract miner's phthisis would certainly be double that of their gangers; thus after about 7 years it can be taken that 100% of the machine-boys have contracted the disease. As a matter of fact it is highly probable that very few machine-boys who were running machines 7 years ago are alive today. Here then we have one reason for the shortage of native labour. It is a noticeable fact that few of the natives, returning again from their kraals to work on the mines, are old previously-trained machine-boys; in fact, there is such a scarcity of good machine-boys that some of the mines at the present time are making arrangements for having a few good machine-boys transferred from one mine to another to teach the raw boys coming in. The present is the best time that could have been taken to bring forward the worst figures regarding miner's phthisis, as the miners are only just beginning to realize the seriousness of the question and its causes and means of prevention; whereas in the past, miners thought nothing of going back amongst all the dust and noxious fumes created by blasting, to see how their holes had broken. No wonder most of them today have phthisis. The official report of the commission is anxiously awaited, and the serious aspect of the phthisis question, which will then be disclosed, will, it is hoped, speedily cause the whole of the mining community to work together wholeheartedly to eradicate this dreadful scourge.

**Respirators.**—With systematic watering of the broken ore, and with the use of water under pressure for the prevention of dust during the drilling of dry holes, a much less dangerous amount of dust is now in circulation in the mines here than was formerly the case. The underground air will still never be entirely free from dangerous dust, especially where the drying effects of large mechanical ventilation schemes are felt. In addition to dust, miners will on many mines be subjected, for longer or shorter periods, to the smoke caused by blasting, either that from other parts of the mine in which they work, or that from blasting in adjacent mines. To prevent any smoke or dust reaching their respiratory organs, the continual use of an efficient respirator by all underground employees, while at their work, is most important. The efficacy of a good respirator is today being slowly but surely forced upon underground employees of all classes, and it is gratifying to see how, within the last 18 months, in fact since the discussion on Sydney Penlerick's paper, entitled 'Ventilation and Health Conditions on the Mines of the Witwatersrand' at the meetings of the Chemical, Metallurgical, & Mining Society at the end of 1910, the production of an efficient respirator has been exercising many minds. Up to quite recently, the old sponge type of respirator was the only one obtainable, and it was considered *infra dig* for any miner to wear one. Latterly, several new types have been put on the market, chief among which are Aymard's baffle-respirator and the Stobie respirator. The former has been almost entirely superseded by the latter, which is made of flannel, so as to cover the nose and mouth, the breath expired being sufficient, after a few moments, to make the flannel damp enough to catch any dust drawn upon it. Experiments are only now required to determine what class of flannel or material of the same type will catch most readily the maximum amount of dust. Set first by members of the underground staffs, it is now becoming the fashion for white miners and also natives to wear respirators, and the keenness displayed by the best and most careful men over the proper use of their respirators augurs well for the future.

**Accident Death-Rate.**—In the discussion on J. Chilton's paper on 'Accidents in Transvaal Mines' some astounding figures showing the enormous number of changes which take place in the personnel on the mines, and their relation to the accident rate, were quoted. R. N. Kotze, Government Mining Engineer, at the suggestion of Dr. Donald MacAulay, found from the government statistics relating to the changes occurring on the mines for the six months January to June 1911 that for 53 mines employing in all an average

of about 20,000 men per month, there occurred no less than about 16,500 changes among the white employees, or roughly 2700 changes per month. The highest rate of change on any one mine was 31%, and the lowest was 4%. The figures showing the relationship between the rate of change of white employees and the death-rate from accident point conclusively to the fact that as the rate of change of white employees increases, so does the death-rate from accidents. The figures for the year 1911, showing the relationship between the rate of change and the accident death-rate, were:

| Average number of changes per month per cent | Death-rate from accident per 1000 per annum | |
|---|---|---|
| | Jan. to June | July to Dec. |
| 4 to 5 | 3·47 | 0·93 |
| 6 to 10 | 2·85 | 2·83 |
| 11 to 15 | 4·10 | 4·17 |
| 16 to 20 | 4·34 | 3·80 |
| 21 to 25 | 4·96 | 5·00 |
| 26 and over | 5·10 | 5·08 |

Although naturally the accident death-rates for the two half-years do not exactly agree, yet on the whole the death-rate rises with the number of changes. The high death-rate from accidents on the mines of the Witwatersrand is certainly not due to these mines being more dangerous than mines in other parts of the world. On the contrary, they should be safer. Safe as any mine may be, however, in order that a maximum of safety may be obtained, it is necessary for underground employees to be thoroughly conversant with the purely local conditions in which they work.

## SAN FRANCISCO.

**Goldfield Consolidated.**—Much interest attaches to the delayed annual report of the Goldfield Consolidated Mines Co. for the year ended October 31, 1911, which finally appeared early in February. It is an account of a prosperous year and shows that during that period 330,549 tons of ore of an average gold content of $32·55 per ton was treated at an operating cost of $7·55 for a net recovery of $30·74 per ton, or a net realization for the year of $10,163,127. During the year the new refinery was completed, having been put in operation on January 31, 1911; it works successfully, having reduced the cost of treating bullion from 19c. per ton of ore to 7c., corresponding to a saving of $60,000 per year. An extension of plant to re-treat the residue from the present plant is now under construction, and will include two Edwards 13 by 112-ft. roasting furnaces and a 5 by 18-ft. tube-mill, with accessory equipment. This is estimated to cost $73,000 and is expected to make a saving to the company of $80,000 per year. During the year $7,118,296 was paid in dividends, being at the rate of $2 per share. No detailed statement of ore reserve is given in the report, the only mention made of this important topic being in effect a personal statement by J. F. Thorn, the general superintendent, that in his opinion 600,000 tons of ore, or approximately two years' supply of ore for the mill, can be counted on, though this will probably be of slightly lower grade than the average of that treated during the year. Assuming that Mr. Thorn's judgment is correct, the present selling price of the shares represents their present value on the basis of two year's dividends and the division of the surplus, and is in strong contrast to the usual selling prices of shares, where the speculative feature is given a high valuation. It is good, therefore, to see that the financial status of this wonderfully productive gold mine is on so conservative a basis.

**The Tariff.**— Proposed changes in the tariff on metals and ores are causing much discussion in the Middle West and Rocky Mountain States. The Underwood bill, which has already passed the House of Representatives and will probably pass the Senate, though possibly in amended form, provides that zinc and zinc in ore produced in foreign countries shall be admitted free of duty, while pig lead and lead in ore shall be subject to a duty of 25% *ad valorem* instead of the former 2⅛c. per pound. Naturally the producers of lead and zinc ores are up in arms against the bill and organized efforts are being made to defeat it. The reduced rate on lead would certainly tend to the disadvantage of Idaho, Utah, and Colorado producers, as it would allow the bringing in of Spanish and Mexican lead. It has been urged that the American Smelting and Refining Co. would reap some advantage over the competitors by the proposed change, since its competitors either possess mines or have contracts for supplies from mines within the United States, while the A. S. & R. Co. owns mines in Mexico and its lead smelters in Colorado are not now operating at anywhere near full capacity. Mexican lead ores are now being smelted in bond at the A. S. & R. Co. plant at Maurer, N. J., and to a less extent at the Selby plant, San Francisco. It seems scarcely likely that lowering the duty would cause any great increase in the tonnage of Mexican lead ores shipped to the United States, for the ten smelters now in operation in Mexico are in a

position to compete freely with the United States plants for ore. The zinc smelting situation is more complicated, and the ore producers and smelters have been wrangling for years over the rate upon imported ores, so that the new proposal will only accentuate the discord.

**Giroux.**—After a long period of 'marking time' the Giroux Consolidated Mines Co. has begun to take vigorous steps toward starting actual production. This company has spent several years in prospecting its ground with churn drills, and in explorations through shafts, the 1400-ft. Giroux shaft having been sunk in a search for rich orebodies which it was hoped to find along the limestone contact, but the results are as yet somewhat disappointing. In his annual report, for 1911, the president of the company, T. F. Cole, stated that 10,291,000 tons of ore averaging 2% copper has been developed, with an additional 6,600,000 tons averaging 1·65% copper. Much of this ore is near the Liberty pit of the Nevada Consolidated Copper Co. and can be advantageously shipped in co-operation with that company. Recently a contract has been made with the Nevada Consolidated to ship a minimum of 900 tons and a maximum of 1200 tons per day to the Steptoe Valley mill of that company, beginning May 1, 1912. At present the Nevada Consolidated is the only company in the Ely district which is producing any copper.

## TORONTO.

**Porcupine.**—Owing to the severity of the winter the springs and small streams of the Porcupine area have been frozen solid, causing a scarcity of water, thus compelling a number of mines to close-down or curtail operations. The weather is now milder so the difficulty will not be of long duration. Everything points to great activity as soon as the thaw is complete, but much depends upon the results obtained from the first actual milling operations at the larger mines, which are eagerly anticipated as a criterion of the value of the camp. The McIntyre now appears likely to be the first in the field, and it is hoped to begin work with its 10-stamp mill by March 1. The date for the opening of the Dome mill is officially fixed for March 22, and the event will be made the occasion of a public celebration including winter sports and a banquet, to be attended by a large number of mining men from a distance. As the mill when in full operation will crush 250 tons per day, the drill capacity has been increased from 12 to 24, so as to maintain the tonnage and block-out a large reserve. In order to keep shafts 1 and 8 free for development purposes, an adit is being run from near the mill to No. 1 drift at 45 ft., through which the ore will be brought in trucks and hauled from the workings to the surface by a hoisting drum. Charles M. Henrotin, formerly manager of the Kimberley diamond mine, has been put in charge of underground work, and George S. Poore, who has also had experience in South Africa, has been appointed mechanical superintendent. The Vipond mill is expected to be in readiness for operations early in April. It differs in principle from the other mills as stamps are not used; instead, the rock is put through crushers and Hardinge mills and reduced to 120-mesh. Its capacity will be 150 tons of ore per day. A blind vein cut when opening the station at the 200-ft. level shows about 5 ft. of ore, yielding $20 per ton. Several good finds have been made on the Dome Extension. A vein which outcrops on the surface has been struck in diamond-drilling at 227 ft. where it contains about 15 in. of ore, running $50 per ton. A cross-cut at the 100-ft. level is in an orebody, which shows gold for 27 ft. and is rich in places. The North Dome is in good ore at 60 ft. in No. 2 shaft, where the vein is 2 ft. wide and rich in free gold. The Crown Chartered will complete its payments on the Davidson property, which has been held for some time under option. New machinery is being installed: the orebody on the 100-ft. level will be developed and sinking continued to the 200-ft. level. At the McEnany, operated by the Crown Reserve Co., a new vein has been cut at the 100 and 200-ft. levels. It is about 3 ft. wide with assay-values well maintained at depth. The Rea is sinking the shaft from the 300 to the 400-ft. level where a station will be cut. The Imperial has closed until additional funds can be obtained and machinery installed. The Standard has a rich orebody in the shaft at 49 ft., the vein being on the contact of the porphyry with Keewatin schist. Sinking has been commenced on the south side of Pearl Lake, which is rich in surface showings. The McIntyre has driven on the vein of No. 4 shaft at the 200-ft. level for about 200 ft., the ore running about $16 to the ton. The other shafts are in equally good ore. The Little Pet, which is in the charge of Proctor Smith, has ordered a Jenks mill of 5 stamps. The Dome Lake has two shafts down 60 ft. on a vein 3 to 4 ft. wide on the surface, samples from the bottom of the shaft running $23 to the ton. Diamond-drilling, however,

shows that the vein narrows considerably at depth and that values are not maintained. Work has been resumed at the Success property. The American Goldfields has struck a good quartz and schist vein 5 ft. wide at the 500-ft. level with the diamond drill.

**Cobalt.**—An important discovery has been made at the Coniagas mine, disproving the generally accepted theory that the Cobalt mines were at bottom when the Keewatin formation was encountered. In stoping on No. 9 vein the ore was found to be continuous when the Keewatin was reached, and it was followed for 25 ft. when it widened to 5 in. of high grade. An assay taken from ore 85 ft. in the drift in Keewatin showed 2622 oz. silver per ton. Assistant Provincial Geologist, Cyril W. Knight, made an official inspection of the find, and after examination of the formation pronounced is undoubtedly Keewatin. This discovery will lead to the thorough prospecting of properties hitherto supposed to be barren. The lease held by the Little Nipissing from the Peterson Lake Co. has been forfeited under a provision for its cancellation in case work should be suspended for one month. The property is now being worked by the Peterson Lake. The La Rose is developing its subsidiary properties with good results. In a winze put down from the 60-ft. level of No. 9 of the Lawson, good ore has been found for 45 ft. downward, the vein averaging 7 in. of 2000-oz. ore. At the Princess the main stope 225 ft. in length is full of ore from the second level to the surface, and in the winze below the second level a 1½-in. vein of high-grade ore with several feet of milling rock on either side is being opened. At the La Rose proper where the main vein faulted at 152 ft., deep mining is being undertaken with the view of discovering orebodies in the underlying conglomerate. The production of the Nipissing for January was estimated at $224,903, being a slight fall. Another orebody has been opened on vein 122. It was 6 in. wide of 6000-oz. ore and will be developed by a rise from the second level. On the Meyer vein, 230 ft. of the east drift is in ore, the face of the drift assaying 2500 oz. for a width of 8 in. A shoot of rich ore has been struck in driving at the 100-ft. level of No. 1 shaft. At the Provincial, of which John Riddington is manager, a 1½-in. vein of high-grade ore, with wall-rock charged with silver for two feet on each side, has been encountered in the conglomerate on the 300-ft. level. The annual report of the Temiskaming shows a production of 1,213,754 oz., of the value of $643,322, with a net profit of $271,423. The cash balance on hand is $320,438. The annual report of the Trethewey for 1911 showed a decrease in production from 865,777 oz. in 1910 to 770,838 oz., the decline being attributed to the fact that much of the mining was done in old workings, and a large amount of development accomplished. The total receipts were $372,622 and the net profits $160,306. The Wettlanger, of South Lorrain, had a good year, its annual report showing receipts $481,368,

*GILLIES LAKE, PORCUPINE.*

expenses $167,977, and net profits $313,390, of which $212,488 was paid in dividends. Shipments amounted to 925,017 oz. of silver and the ore reserves were estimated to contain 1,003,000 oz. The Wettlanger has taken on option the ill-fated Keeley mine of South Lorrain, one of the assets of the insolvent Farmers' Bank, agreeing to expend $15,000 per month for one year in developing the property. The Cobalt Townsite, mainly owned by British capitalists, is the latest addition to the list of dividend payers, having declared a dividend of 5% for the current quarter. The Colonial, which went into bankruptcy in December, has been reorganized and will issue bonds for $200,000 to raise funds for development.

**Gowganda.**—There is some revival of interest in the Gowganda region where several mining properties have recently changed hands. The Miller-Lake-O'Brien has been making steady shipments of high-grade ore for over a year and has recently opened an orebody 140 ft. long. In the main vein, where operations are being carried on at the 250-ft. level, the ore is found to improve with depth, the vein containing from 1½ to 6 in. high-grade ore, with considerable silver in the wall-rock. The difficulties of transport have closed several promising properties, which, with railway communication, would have every chance of becoming remunerative.

**Eight-Hours Day.**—The Premier, Sir James Whitney, has introduced into the Ontario Legislature a bill providing that no miner shall be employed underground for more than eight hours in any twenty-four hours, including the time occupied in descending and ascending from the mine. The penalty for disregarding this provision is a fine of $50. This measure has been anticipated by some of the mine owners of Porcupine who have already conceded the 8-hour day.

**The Temiskaming & Northern Ontario** Railway Commission has finally decided the route of the Elk Lake branch that is to be built this season. It will diverge from the main line at Earlton, 25 miles north of Cobalt, running westward for about 30 miles. Tenders are to be advertised immediately.

**The Asbestos Industry** is in a depressed condition and another company is unable to meet its obligations. The balance-sheet of the Black Lake Asbestos Co. for the six months ended November 30 shows a net loss of $42,325, and it is officially announced that the company will be unable to pay the interest on its bonds due in March.

## NEW YORK.

**Copper.**—Among the copper mines the 'porphyries' continue to hold of chief interest. The Inspiration merger, announced during December last, has been widely discussed. The Inspiration Consolidated Copper Co., the new company, has been underwritten by J. P. Morgan & Co. to the extent of $30,000,000 in shares and $6,000,000 in convertible debentures. The shares of the old Inspiration company are being exchanged on the basis of two shares of old stock for one of new, while the Live Oak shares are being exchanged on the basis of two shares of the new for one share of Live Oak, or at the rate of $10 per share for Inspiration and $40 per share of Live Oak, shareholders having the privilege of selling instead of exchanging if they so desire. Another recent consolidation is that of the Ray Central Copper Mining Co. and the Ray Consolidated Copper Co. The Ray Central company was organized in 1909 with a capitalization of $6,000,000, and according to a report upon the property made by Weed & Probert early in 1911 the company has on its property 5,020,000 tons assured and 1,420,000 tons probable ore, with an average assay of 2·15% copper. Estimating on a basis of a production of 1000 tons per day, the probable total cost is placed at $2·97 per ton, equivalent to 10·38 c. per pound of copper. Recently the shareholders of this company authorized the issuing of $1,800,000, 6% convertible bonds. The Consolidated company was organized in 1907 and its capitalization has been successively increased until it now reaches $12,000,000 and will be further increased to $13,500,000. The ore reserve was recently estimated by George L. Walker at 75,000,000 tons. Production began in April 1911 and steadily increased until December, during which month 2,600,000 lb. of copper was produced, a total of 15,500,000 lb. for the nine months. The fifth unit of the mill has recently been placed in operation, so that the production should continue to increase. The present equipment, when completed, is expected to treat 2,800,000 tons of ore per year. The management of this company is almost the same as that of the Utah Copper Company.

The report of the Utah Copper Co. for the quarter ended December 31 has just been issued, and shows a total net profit for the period of $2,157,765, from which $1,177,012 was paid in dividends, leaving a surplus of $980,753. The production of copper for the quarter was 26,818,247 lb. (a monthly average

of 8,939,416 lb.), making a total for the year of 98,436,224 lb. A seventh unit in the Arthur mill was put into operation during January, but the amount of ore now being treated is not increased, as the climatic conditions during the winter are not favourable to open-cut mining. This applies with even more force to the Nevada Consolidated Copper Co., as the winter is more rigorous at Ely than at Bingham. The production of this latter company for the fourth quarter of 1911 was 15,434,788 lb. or a total for the year of $62,842,675. The income for the quarter was $1,088,644, from which $749,289 was paid in dividends, leaving a net surplus of $339,255. The rise in the price of copper at the end of the year greatly stimulated interest in copper production, but the prospect of a continued rise in the price of the metal now seems doubtful.

**Cripple Creek.** — Gold production at Cripple Creek has steadily declined from $18,000,000 in 1900 to $11,000,000 in 1910 and $10,500,000 in 1911. The gradual depletion of the richer ores from the upper levels of the minable area has led to an increased production of low-grade ore, the increased quantity of which has not served to maintain the total of gold production. The future now looks brighter because of the increased effectiveness of the Roosevelt deep-drainage adit, which is now draining the mining area at the rate of 8½ ft. per month. The El Paso mine is dry to the drainage-adit level, which is 1338 ft. below the shaft collar, the Portland has recovered its 1500-ft. level, and the Independence its 1000-ft. station. This will make possible the mining of the deeper levels and, presumably, an increased production of high-grade ore. Several mills treating low-grade ore are in steady operation, the most successful of these being the mill of the Portland Gold Mining Co. at Victor. The results of the operation of this mill are given in the annual report of the company, which has just been made public. In December 1911, 12,285 tons of ore of a gross value of $35,432, or an average of $2·80 per ton were treated. Of this content $28,533, or 80·5%, was recovered at an operating cost of $1·13 per ton. During the year the mill also treated 120,961 tons of waste from the former milling operations, having a gross content of $424,490, or $3·51 per ton. On this an average extraction of 81·4% was made. The net operating profit of the mill for the year was $128,739, or a return of 38% on the cost of construction of the mill, which was $338,581. The conspicuous success of this mill will encourage the treatment of low-grade ore at Cripple Creek, and the productive life of the district will be correspondingly prolonged.

## MELBOURNE.

**In North Queensland** the event of most importance is the delay in the negotiations for the amalgamation of the Hampden and Mount Elliott companies. As has before been pointed out the rock on which things split was the question of control. It is understood that the directors of the two companies were willing to merge them into one powerful company on the basis of two shares to the Mount Elliott company and one to the Hampden company, which proves that £200,000 of the cash resources of the Mount Elliott company was to go to the credit of the new company. But Australia wanted the control and the end of it was a block in the negotiations. Now they have been resumed, but the insistence of the Mount Elliott board that the Duchess mine belonging to the Hampden should be sampled by its expert has led to Hampden directors demanding that the Mount Elliott mine should in turn be sampled by their general manager. The result of this line of action must be a thorough overhaul of the two properties on a most conservative basis. The Hampden people are very confident as to the result especially as they are aware that the bottom level of the Mount Elliott is in poor stuff. Indeed quite a powerful section of the Hampden shareholders would be delighted if the negotiations were off altogether.

**The British Broken Hill** sensation is not at an end. Trouble arose through an ex-surveyor of the mine named Thomas publishing diagrams purporting to show that there had been a tremendous official over-estimation of the ore reserves developed at Thompson's shaft. G. C. Klug, general manager for Bewick, Moreing & Co., was called in by the directors to examine the property and he subjected it to an overhaul such as no other mine at the Barrier has ever had to experience. Mr. Klug's competence and fairness was questioned at the outset by Mr. Thomas, the ex-surveyor, but those who are able to estimate ability and integrity know that Mr. Thomas's sneer was absolutely without warrant. Now that the report is out it is remarkable that he claims that Mr. Klug has verified his assertions. How he can have the confidence to make such an assertion is incomprehensible, in view of the fact that where he said there was 5 ft. of ore, Mr. Klug points

out that the cross-cut has gone through 95 ft. of ore. Mr. Klug deals only with the recent development in Thompson's section, and he asserts that the results obtained by him are confirmatory of those stated by the management. It may be said that Mr. Klug's examination has been carried out with such thoroughness and such skill as to impart great confidence in his firm and in him. All the same the market received a most severe shock in consequence of the assertions of Mr. Thomas, and with over-bought operators unable to stand the strain, some large dealers have gone under.

**Mines and Journalists.**—At Bendigo the mining journalists of the leading papers take a great pride in their work and follow developments closely. They have been allowed from the earliest times to pop up and down the claims on any day, and consequently have kept the investing public informed not only as to what was actually happening but as to the possibilities ahead. Seeing the training of these men and the experience they can gain by contrasting geological occurrences in one part of the field with those in another part, their reports are highly appreciated by mine managers and shareholders. Not long since the management of one large company decided to withdraw from the mining journalists the privilege of going below, save on the regular visiting days for the public and to compel them to apply for an order. The result has been a Press boycott. Wailings have arisen from the investors in the property because these rely on the reports of the journalists for information rather than on the formal reports of the mine manager. Dealing in the shares was only kept alive by the propping tactics of the supporters of the stock. The incident is given because it illustrates the part that newspapers now play in Australia in keeping an oversight on mining. In the main the criticism to which the mines and the management are subjected is honest, and for the good of the shareholder. Directors may not like the candour with which their conduct is reviewed, but the people appreciate it, and rely on the Press to furnish information to account for the vagaries in the share market. It is fortunate that such confidence is mostly well placed.

**Present Conditions in Australia.**—We have made a start with a new year. Unfortunately it cannot be said that the beginning is propitious. The basis of all successful mining is sound finance and the co-operation of labour with capital. Taking the last essential first, there is no hope of anything but conflict between the man who has capital to invest and the worker. The country at the moment has as its Federal rulers men belonging to the labour party. They represent the caucus, and the caucus is really the expression of the wire-pullers in the labour ranks; men who having either flung down their tools to assume office in some union or having aspirations in that direction see the way to their own advancement by setting the employee against the employer and by stimulating discontent wherever peace may be present. Ignoring the teaching of experience, paper money is being forced upon a people who do not want it or who do not understand what wrong currency means. Then a Commonwealth Bank is being established to handle the savings of the thrifty poor by utilizing them for banking purposes, instead of letting them repose in safety in Savings Banks. When such a programme is being carried through in the face of the warnings of those who know the value of sound finance, it is no wonder that financial institutions are calling a halt. These in no way dread the opposition of the State institution, but they foresee that the ambition of the labour party is to cripple the man with capital by either fighting him with weapons forged in the State armoury or to grab his wealth. The Federal land tax is being more than rivalled by State taxation of the most extreme nature, with the object of depriving land-owners of their possessions. That people in a country like ours should have to lose five shillings per pound of their income from land in order to feed the Federal and the State treasuries in a time of peace in an oppression as wanton as any recorded of King John. The country is standing this class of legislation simply because it has enjoyed a decade of marvellous prosperity. Bankers now however are not only preparing for the conflict with the Commonwealth Bank, but they are making their position secure by compelling a reduction in overdrafts. Their excuse is that the people have been living at such a pace that imports have expanded so much as to lead to an undue shortening of the gold reserves. Hence the necessity for compelling sober living and checking boom enterprise. Their action is having a direct effect on mining, for advances on mining shares are being called in, and companies are being compelled to put finances in order. The result is that the share market has been plunged into a dulness that is without parallel of late years. As everyone knows when that occurs people turn from the industry.

# CUPELLATION OF GOLD PRECIPITATE

By CECIL J. BROOKS.

AS much has been published on the treatment of zinc-box precipitate it is not my intention to discuss this matter at length, but to give a short description of the process in use at Bau, Borneo, preparatory to refining the bullion by cupellation, a process which has proved to be a decided advance on pot-refining.

The ore treated at this mine is found in several rocks varying in hardness, and of gold-bearing clay, roughly in the proportion of one of the former to two of the latter. These two classes of ore are slimed and mixed in suitable proportions for filtration; during sliming the clay requires the addition of large quantities of lime to induce rapid settlement; the solutions therefrom, heavily charged with calcium hydrate, readily absorb carbonic acid, precipitating the insoluble carbonate as they pass through the zinc-boxes. Through slight mechanical defects a small quantity of the fine clay is carried into the solution after filtration. This is difficult to remove. Even after the solution has been run into a large settling-vat, it appears slightly turbid, and in the course of the month deposits a quantity of fine material which further contaminates the precipitated gold. The solution is in consequence passed through clarifying presses with beneficial results. The ores contain a notable quantity of arsenic—metal and sulphide—and also antimony, as stibnite; to avoid the solution of these, the caustic alkali is kept at a minimum, but it will be observed from the analysis of the precipitate that they are attached and deposited on the zinc. At the monthly clean-up it is customary to rinse the zinc shaving to remove the easily detached gold precipitate and the shreds of broken zinc. The broken zinc is then washed on a 10-mesh sieve; about one-half is retained for acid treatment, the other being returned to the zinc-boxes where it is spread in thin layers on fine sieves, which are arranged in tiers in the first or second compartment. The wash-liquor, while being pumped through the clean-up press, is agitated sufficiently to keep the precipitate in suspension. The coarse particles of zinc which settle are finally conveyed by hand to the acid-treatment vats.

The large margin of variation in the composition of the precipitate is seen from the following analyses of average samples taken from filter-press cakes:

| | (1) * | (2) † | (3) ‡ |
|---|---|---|---|
| | % | % | % |
| Silica and gangue .. | 17·66 | 2·82 | 38·00 |
| Iron ..... | 3·32 | ·76 | 3·12 |
| Alumina..... | 3·98 | 1·63 | 10·23 |
| Zinc (fine — 100).... | 23·78 | 30·65 | 12·66 |
| ,, (coarse + 100) | 1·14 | 4·36 | |
| Lime ..... | 6·69 | 9·17 | 5·32 |
| Magnesia..... | ·17 | ·39 | — |
| Alkalies..... | 2·27 | 4·00 | — |
| Gold..... | 8·044 | 19·629 | 9·00 |
| Silver ..... ..... | 2·276 | 5·424 | 5·45 |
| Copper ..... | 2·47 | 2·82 | 1·61 |
| Lead..... | 4·80 | 7·86 | 3·28 |
| Tin ..... | ·10 | ·18 | ·62 |
| Antimony..... | | ·11 | |
| Arsenic ..... | 1·68 | 1·67 | ·42 |
| Sulphur ..... | ·62 | ·87 | |
| Selenium..... | ·34 | ·08 | |
| Carbonic acid (and as organic matter) | 10·28 | 6·29 | 10·29 |
| Moisture ..... | 8·79 | — | |
| Oxygen, loss, etc.... | 1·59 | 1·257 | |
| | 100·000 | 100·000 | 100·00 |

* (1) Sample from Bidi coarse-crushing and leaching plant.
† (2) Sample from Bau coarse-crushing and leaching plant; in every way of excellent quality.
‡ (3) A low-grade precipitate caused by turbid solutions.

As the pressed precipitate contains a much larger percentage of calcium carbonate than the coarse zinc, it is acid-treated separately, and the calcium removed by solution in hydrochloric acid, before the zinc is dissolved in sulphuric acid, the procedure being as described herewith. After mixing the slime with sufficient water in the acid-treatment vat, the hydrochloric acid is added in small quantities, testing after each addition by means of a lighted match, which, when an excess is present, ignites the bubbles of hydrogen. The vat is then filled with water and, after stirring, the precipitate is allowed to subside, and the supernatant solution of calcium chloride is pumped into the press. This washing by decantation is repeated at least four times. The treatment with sulphuric acid then proceeds. The formation of calcium sulphate being prevented, not only is the bulk of precipitate reduced, but the production of matte upon the bullion afterwards is also minimized.

The coarse zinc is treated directly with sulphuric acid, but to insure the most complete solution of the copper, the acid is first diluted

and the zinc added in small quantities, waiting between each addition for all action to cease. Thus an excess of acid is retained as long as possible, to hold the copper in solution as it dissolves ; whereas a comparatively small quantity of acid acting on a large mass of zinc causes a concentration of the copper on the decreasing zinc. When the action is complete the precipitate is pumped into the filter-press, and washed until soluble sulphates are absent from the escaping effluent. It is then steamed and dried preparatory to smelting. Smelting is done in coke-fired Faber du Faur tilting furnaces. The quantity of flux necessary is controlled by the quality of the precipitate. A sample such as (2) fluxes well with the addition of 15% of its weight, using a mixture of borax 12% and fine white sand 3% ; while (3) is difficult to fuse with 70% added, using borax and sodium carbonate in equal proportions.

It is the practice when smelting rebellious precipitate to pour when the greater portion has been reduced to metal. Much time is lost by waiting for the small unfluxed portion to disappear, and there is increased wear of the retort. The remaining bullion is afterwards recovered by a reducing smelt.

The slags are ground to a fairly fine powder in a ball-mill, and mixed with 15% of litharge and sufficient carbon to reduce the lead. As the mass fuses, it is well stirred to insure a thorough contact with the reducing agent, and a few pounds of fine iron from the ball-mill strakes is introduced with stirring a few minutes before pouring. A further recovery is obtained by crushing the impoverished slag fine and passing it over a Wilfley table.

This process in two stages might apparently be shortened by mixing the litharge with the original precipitate, collecting the gold and silver in the lead, and thereby cleaning the slag at the same time. Experiments showed, however, that a more complete recovery resulted from the divided operation.

A small quantity of matte is produced, which is removed by hammer and chisel from the bullion-buttons and the precious metals are afterwards obtained by fusion with the same charge of fluxes as is used in slag-cleaning. The recovery by this means appears to be equal to that obtained by reduction with scrap iron, which was formerly the practice, this being illustrated by the following assays :

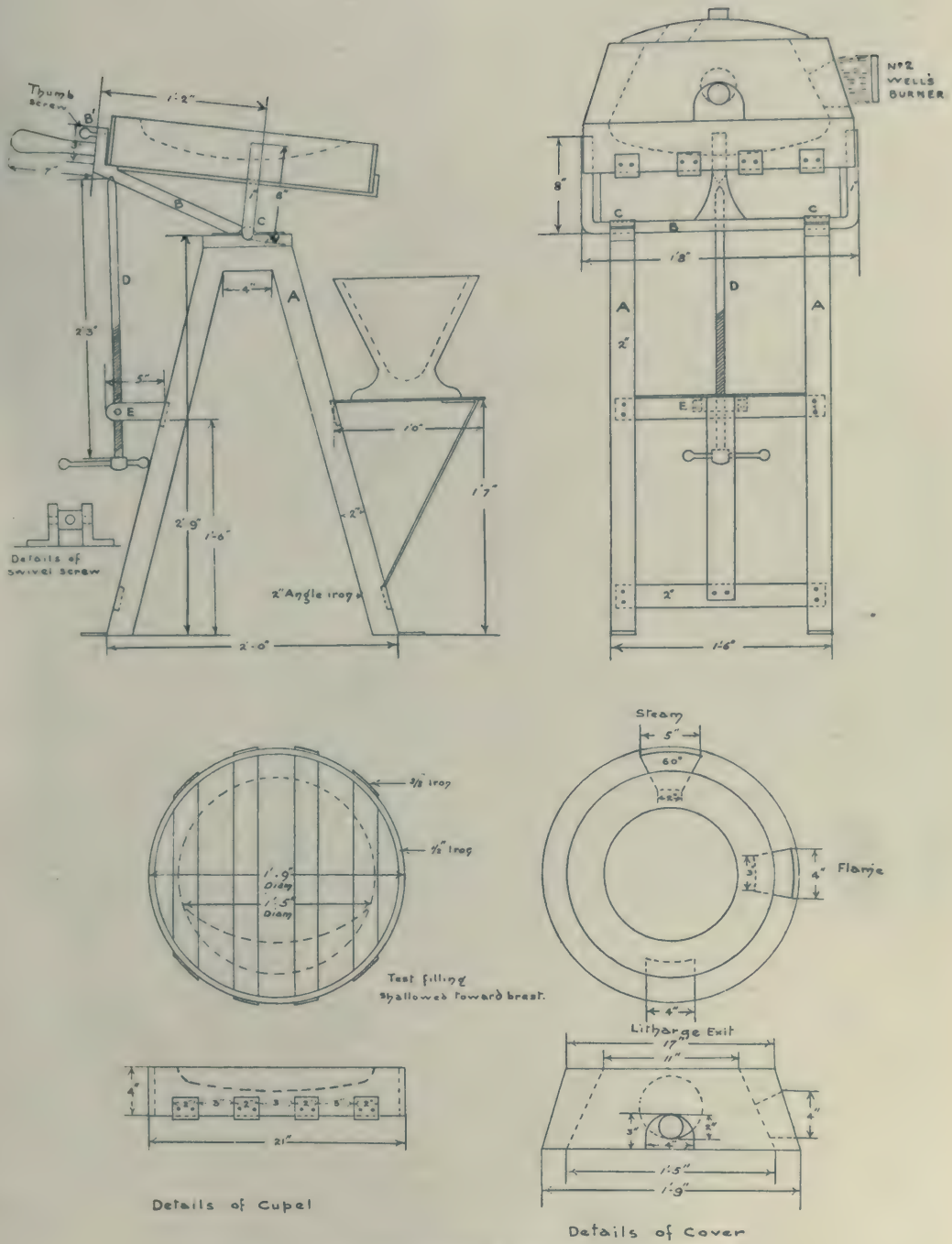
| | Gold % | Silver % |
|---|---|---|
| Original matte from gold bullion..... | 6·88 | 27·61 |
| Matte from lead-bullion after fusion with slag-cleaning charge..... | 0·026 | 3·134 |
| Cleaned by scrap iron..... | 0·024 | 4·460 |

The resultant bullion from all sources generally assays from 800–900 fine gold and silver, but it seldom reaches the higher figure.

For some years it was the practice to refine this bullion by means of nitre, added in small quantities with constant stirring until the action ceased ; then removing the slag by skimming when sufficient had accumulated ; and repeating the process to the desired degree of fineness. This refining was done in French pots, which, to prevent loss by cracking, etc., were enclosed in a graphite crucible, the stirring being done with stout clay rods. The lead bullion was also refined in this way, but was carried no farther than sufficient for the removal of arsenic, sulphur, etc., and was shipped finally as lead bullion. This method is now discarded, as it has been found that by means of a small portable cupel furnace, the lead can be utilized to refine the gold.

The cupel furnace consists of a stand (*A*), constructed of 2-in. angle-iron, bent to shape and held together at the required distance by four cross-pieces of stout iron, as shown in the sketch. This stand supports the T-shaped cupel-holder (*B*), the extremities of which are turned up to grip the cupel ring, which ring is held in place by a thumb-screw (*B*) against the two other uprights, these being so placed that they are slightly past the diameter. The short limbs are hinged at (*C*), and a small piece of iron is rivetted to either side as support for the ring, while the long limb is bent at an angle to meet the test ring, and notched at its extremity to retain the levelling screw (*D*), which is attached to the stand by the swivel (*E*). The test ring is 1 ft. 9 in. in diameter. The filling is supported by means of four iron strips, 2 in. wide, rivetted to the outside at intervals of 3 inches. The ring is filled with a mixture consisting of : portland cement 75 lb., fire-clay 10 lb., fire-brick 12 lb. These materials are ground to pass 40-mesh, and mixed with sufficient water, bind when pressed in the hand. About half-an-inch is then tamped into the ring to form a hard bottom, after which the remainder is added and tamped until hard. The cavity to hold the bullion is then marked and scooped out, 2 in. deep at the centre and rising gradually toward the breast ; the cupel thus prepared is allowed to dry in a warm place for at least a month. When a stock of old cupels is available, 50 lb. of this material may be substituted for portland cement, and the mixture modified proportionately.

The cover is made of a mixture of asbestos (boiler covering) 50%, fire-clay 40%, powdered




*DETAILS OF CUPEL FURNACE FOR GOLD PRECIPITATE.*

fire-brick 20%, with enough water to render it plastic, and moulded round a truncated cone, turned to the dimensions of the cupel hollow. Wire netting of ½-in. mesh is embedded near the external surface and a stout iron-wire ring is placed about one inch from the top. When nearly dry the working door and entrances for the flame and steam are cut out with a sharp knife; the wooden mould can be removed when the drying is nearly complete. For the lid an ordinary 'salamander' pot-cover is used. This is raised slightly on the side where the flame enters, to allow for the escape of the gases, by the insertion of a piece of broken crucible. Oxidation is induced by means of a fine jet of steam which causes a current of air to enter through the aperture. An air-blast would doubtless be more efficient, but as there were no facilities for procuring it, the former was used. The source of heat is a Wells light fitted with a No. 2 burner.

On setting up the furnace for cupellation, the cupel is levelled by means of the screw, and contact is made between the cupel and cover by dusting a thin layer of bone-ash round the edge before being placed. The temperature of the cupel must be raised very slowly, and at least half-an-hour should elapse before the full flame is allowed to enter the furnace. As soon as the interior is at a bright red heat, the bullion may be introduced by removing the lid. About 50 lb. constitutes a charge and this should contain about one half its weight of lead. The steam aperture and litharge exit are closed by inserting pieces of coke, and the temperature is allowed to rise until the bullion melts and assumes a red heat. The steam jet is then adjusted and inserted, and cupellation commences. A little litharge and borax thrown over the surface will facilitate the initial uncovering.

The first litharge formed is absorbed by the test, but directly it commences to collect on the surface, the front level is lowered by turning the screw, and so adjusted that, as it forms, it runs over the test and flows in a thin stream into the mould placed on the stand below. The operator seated in front can easily reach the screw by using a thin iron rod, about 3 ft. long, the end of which is bent at right angles. This rod is also used to direct the flow of the litharge and to remove from the surface of the melt any lumps which may occur.

When most of the lead has been cupelled, the furnace is again adjusted horizontally and more bullion is added, this operation being continued until the cupel is nearly full of fine bullion. The last litharge, which cannot be made to flow over the edge, is absorbed in a little bone ash thrown on the surface; this, when saturated, is carefully raked to the front. If much copper is present, the addition of more lead may be required for its elimination.

Before pouring, the steam is shut-off and the temperature raised to the full heat of the lamp. The bullion is then poured into a large conical mould, by an assistant raising the handle, either directly or by means of a cord passing over a pulley suspended from above and attached to a balance weight. A removable handle, bent over the top of furnace, would be probably more satisfactory.

During a typical day's run of twelve hours, the following weights of bullion were refined: Gold bullion 150 lb., 836 fine gold and silver. Lead bullion 170 lb., 133 fine gold and silver.

The resulting refined bullion assayed 953 fine (gold 685, silver 268). An average sample of the litharge assayed 599 oz. per ton, gold and silver, including 121 oz. collected as metallics on a 100-mesh sieve.

The litharge is of course used to clean the next month's slag, so that its valuable contents are kept in a closed circuit.

Frequently the test cracks, but never seriously, and a few drops of lead may leak through when the melting-point of the alloy is low. This, however, is caught in a tray placed below, or stopped immediately by applying a damp cloth to the crack. A little matte adhering to the bullion is readily oxidized, but speiss is extremely troublesome, requiring for its removal repeated additions of nitre and borax at the highest temperature obtainable. The consumption of paraffin oil is small, 6·5 gallons being sufficient to cupel 100 lb. of lead. The bullion is finally melted in No. 80 'salamander' pots, from which samples are taken for assay, and the metal is then cast into bars for shipment.

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**Hydro-Electric Power.**—The largest installation in the world for producing hydro-electric power will be that which is now under construction at Keokuk, Iowa. The dam across the Mississippi river will be 4568 ft. long, and will be the longest in the world with the exception of the Assouan dam in Egypt. The plant when completed will provide 200,000 horse-power. The hydro-electric installations already at work in the United States have a total capacity of 1,400,000 horse-power. The Keokuk project started with a contract with a firm in St. Louis to take 60,000 h.p. for 99 years, the price to be readjusted every ten years in accordance with the price of coal.

# LABOUR CONDITIONS ON THE LOWER AMUR

By D'ARCY WEATHERBE.

THE Russian Government was fortunate in its happy selection last year of such a progressive Governor General as Mr. Nicholas Gondatti for the Primorsk province of Eastern Siberia. Although Mr. Gondatti is frank in his sympathy with the policy of 'Russia for the Russians,' his earnest desire, above all petty or political feeling, is the wholesome and energetic development of the natural resources of this enormous territory, rich in gold and timber, and containing fisheries the most prolific in the world.

Mr. Gondatti admits that foreign capital is necessary for such development as that for which he is striving, and there can be no doubt that its introduction in good faith will receive every reasonable encouragement. In fact, his views have been practically demonstrated by substantial assistance to the British dredging enterprise, near Nikolaievsk, of which I was in charge in 1910 and 1911. There the fullest indulgence allowed by the spirit of the law has been permitted and nothing more could in reason be asked.

*Chinese in Dredge-pit at Kolchan.*

The new Governor General, however, is unalterably opposed to the employment of Chinese labour in Russian territory, a view which when carried into practical effect will undoubtedly have far-reaching results on the gold-mining industry as it exists today. Nearly all the mines are being operated by manual labour, either excavation by hand, transport by barrow or horse, and washing by water-power in the trommel machine, or else excavation, transport, and washing, entirely by hand-labour, as is customary in the *starateli* or tribute system.

In the watershed of the lower Amur and Amgun rivers, from Habarovsk to the sea, a region where permanently frozen gravel is unknown, where gold may be panned in nearly every stream, and where immense flats containing hundreds of millions of cubic yards of auriferous gravel are known to exist, in which never a drill or a pit has been sunk to bed-rock, thousands of men are washing gold every summer. Of these about 90% are Chinese and Koreans, but the former are in a large majority. The coolie, with his frugal habits and abstemious manner of living, does not spend more than 20 to 25 kopecks per day on himself and large numbers remain in the country during the winter, though only in a few places is alluvial mining carried on from November to May. With their almost incredible capacity for hardship, and their mysterious methods of migration, the first signs of opening spring find most of them, like ants, back at the *lotok* and *butara*. No provision of houses, fuel, or water is asked from the mine-owner, and the workman does his 12 hours per day without worry or expense to the latter. On the other hand, the average Russian labourer must by law be provided with comfortable houses, fuel,

and water, hospital, and indemnities in case of accident, and he is often transported to and from the properties with his women, children, and household goods at the mine-owner's expense. A heavy fixed charge for the maintenance of such a camp is involved, while strikes, disputes, dirt, and drunkenness, besides about 20% of idle time for legal holidays, are necessary accompanying evils.

A prominent official with an intimate knowledge of the Far East, who was lunching with me a few weeks ago in St. Petersburg, told me that the expulsion and exclusion of the Chinese from the Russian territory north and east of the Amur was now being systematically carried out, but with as little show of force as possible. Stringent orders have gone out to the various police organizations throughout the region to deport every Chinaman without a passport, and no fresh passports will be issued to coolies. The basic reason for this action is that the Chinaman is said to hoard his gold, stolen or honestly earned, and his wages from work at the fisheries, so that the bulk of it finds its way back to China.

To offset the immediate loss that will be sustained by this movement, inducement is offered to the Korean to become a Russian subject, and it is stated that the local police may issue temporary passports simply on the statement of a Korean that he intends to be naturalized. Very few Koreans are taking advantage of this.

If this country is thus quietly but effectively rid of the Chinese coolie, the mining industry in its present form must quickly find a suitable substitute; otherwise it will dwindle and die.

The alternatives by which it is proposed to replace Chinese labour are as follows, but it is difficult to see how any of them will avail:

(1) The present native population of the region. This consists of the native Tungoose and Giliak, neither of whom do manual labour for hire; a scattered and moving handful of lawless Caucasian tribesmen, a few naturalized Koreans, and the sparse Russian population, consisting mostly of convicts or relatives of convicts, more of less recently released from the penal settlements in the island of Sagalien. The above sources would probably not provide more than 10% of the number at present employed in mining.

(2) Specially imported labour. It has been the custom for several years to bring several thousand labourers by the early steamers arriving at Nikolaievsk in June for the purpose of working the fisheries from July till September. In the past these consisted of Russians, Koreans, and Chinese. Last summer Chinese and Koreans, with the exception of those Koreans who had obtained Russian passports, were excluded by law from engaging in this industry, which is expanding rapidly, and though many of those prohibited were illegally employed, there was a serious shortage of labour. The labourers thus imported leave on the last boats which go from Nikolaievsk during the first two weeks of October. Even if a similar influx could be induced to come for the mines, the uncertain reward offered by *starateli* work, the wide separation of the properties, and the unorganized state of the industry would render an efficient or prompt distribution impracticable. Moreover in the majority of cases the labour would be required about six weeks before it could arrive, and for some weeks after it is necessary to catch the last boats for the south in the autumn.

(3) Colonization of this great northern wilderness seems a forlorn hope. Time and again efforts have been made during the past decades to settle this region with immigrants from the Ural mountains or from the southern portions of European Russia. Expeditions have been sent out at a heavy cost and surveys have been made by the Goverment, and an immigration office is maintained at Nikolaievsk, but with what result? Practically none. A few scattered hamlets strewn along the beaches of the Amur, bearing names similar to the villages from which the original settlers were drafted and now containing a few degenerate Russian families, are all that there is to show of the movement. The reason is not far to seek. The eastern shore of the Amur for almost the whole of the 1200 versts from Habarovsk to its mouth is a rocky inhospitable wall, while on the western side vast tundra-covered marshes and swampy forests extend far to the interior.

The Russian peasant rudely uprooted from generations of servile life under the communal system of the West and from the paternal shelter of the Church finds himself suddenly transported to a land untilled and untillable. He retains his communal instincts and lives huddled in log shanties on the shore, but, giving up the hopeless struggle against nature, he has sought the line of least resistance and like his wretched Giliak neighbour lives chiefly on fish and vodka. There are a few exceptions, it is true, and occasionally one sees a small patch of green close to the houses and a few scattered cows, but the country is not agricultural and increase of population must necessarily

*YAKUTS ON THE TRAIL, TRANSPORTING PIPE.*

*CHINESE COOLIES SINKING PITS ON THE KOLCHAN PLACER.*

be slow and in proportion to the gradual development of the timber trade and the fisheries. I do not mean to suggest that the Russian peasant is not a good settler where suitable agricultural conditions exist, for one has only to look at the rapidly increasing population that is thriving well throughout the rich and fertile Ussuri valley, between Habarovsk and the main trans-Siberian line, to the south, to disprove that.

Perhaps it is well that the present methods of working the placer deposits of this immense wilderness are to receive a check, for under the *starateli* system they are shamefully wasted. The marrow is picked from the golden vertebræ, represented by the streams of the country, leaving on many rivers large patches and strips of gold-bearing ground of too low a tenor to be profitably treated, whereas by modern methods almost the whole valley from hillside to hillside might have been worked if attacked when virgin.

Dredging, which, in its most modern form, does not require much hand labour, is the natural destiny of the gravel mines of this country and will, it is hoped, work its salvation, but for its development it must look to British and American capital. That dredging for gold can be carried on at a cost per unit of not more than 25% of the present system in vogue I am satisfied from my experience in the country.

The officials connected with the industry with whom it has been my pleasure to associate or meet are almost without exception ready and willing to help any honest effort in the direction indicated, and with such a capable and far-seeing director at the head of the local government the future of gold-dredging augurs well in the Pri-Amur.

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**A Geological Map** of North America has just been issued by the United States Geological Survey. The scale is 80 miles to the inch, and it is printed in four sheets, which mounted together make a wall-map 6 ft. 5 in. by 5 ft. There are 42 colour distinctions representing the various classifications of deposits. The map is supplied at 75 cents, and can be obtained from the Director of the Geological Survey, Washington.

**An Eight-ton Heroult** electric furnace is to be erected at the Vickers works at Sheffield for the purpose of refining steel. A 2½-ton furnace of the same type has been in operation at these works for over a year. The new furnace will use the three-phase current and will be the first of this type to be used in this country.

## An Ocean Motor-Boat.

An epoch-marking event in the engineering world of more than ordinary significance was the departure on its first voyage of the ocean-going ship 'Selandia.' This ship is propelled by Diesel oil-engines of 2500 indicated horse-power, which will drive it at 11 knots. Its dimensions are: length 370 ft., beam 53 ft., depth 30 ft., registered tonnage 4964, and cargo capacity 7400 tons. The vessel has been built by Burmeister & Wain, of Copenhagen, the owners are the East Asiatic Company, and the route to be served will be between Copenhagen and Bangkok, with variations at each end according to requirements. It is stated that the first voyage which commenced on February 26 will be prolonged to Japan. The small amount of space required for the oil-fuel makes it possible to perform a round voyage without refilling, and the fuel will naturally be taken aboard in the East where it is cheapest. There are no funnels, and the exhaust from the engines is carried up the masts. In addition to the main oil engines, there are others which are used for producing the compressed air required for the starting and reversing apparatus, and for generating electric current. Practically all the auxiliary machinery on board is driven by electric motors, namely, the ballast, sanitary, and bilge pumps, the refrigerating plant, the winches, windlasses, and steering gear, and the lubricating-oil pumps. A small boiler is provided, burning oil-fuel, for the purpose of heating the ship.

A sister ship, the 'Jutlandia,' similar in every detail, is being built for the same company by Barclay, Curle & Co., of Glasgow. Burmeister & Wain have another ship of the same type and size nearing completion, and also two larger and two smaller ones. During the last few days it has been reported that the East Asiatic Company has given a further order for two 10,000 ton cargo boats of 3000 i.hp., and that the Swedish Northstar Company has placed orders at Copenhagen for two large steamers.

It is hardly necessary to say that the success of the Diesel oil-engines for marine and other purposes will have a far-reaching effect in many industries. They will spread the use of the internal-combustion motor in many directions where continuity of running for lengthy periods is an indispensable feature.

On her first voyage the ship called at the Thames and a large number of English engineers took the opportunity of examining her design.

# METAL MARKETS

## COPPER.

Average prices of cash standard copper:

| Feb. 1912. | Jan. 1912. | Feb. 1911. |
|---|---|---|
| £63. 0s. 5d. | £62. 17s. 6d. | £55. 1s. 8d. |

Although a further increase in the price of copper has been retarded by influences quite foreign to the metal situation, the demand for the metal has never weakened, and even with the coal strike to check consumption there is no perceptible fall in trade requirements. Substantial decreases continue to be recorded at every successive statistical compilation of stocks, and far from the markets being flooded with supplies from new producers, even these additional resources are unable to keep pace with the world's requirements. Consumers are viewing the steady disappearance of the surplus with some uneasiness. It is well to reflect too that the money released by the absorption of the stocks so long held by European speculators will be used for fresh purchases so soon as the situation is fully appreciated. Even now the general public is watching the position with keen interest. For standard sorts, prices have advanced steadily during the month; electrolytic copper has been held strongly on good sales to consumers both in America and Europe, except where one selling agency attempted to follow the course of standard copper with disappointing results. The restraining influence that weak Stock Exchange markets have exercised in depressing prices has proved an unappreciated but potent assistance to the development of the present activity.

## TIN.

Average prices of cash tin:

| Feb. 1912. | Jan. 1912. | Feb. 1911. |
|---|---|---|
| £195. 4s. 10d. | £191. 14s. 0d. | £189. 12s. 10d. |

The new standard tin contract is now working freely and the result is seen in the decreased activity of the syndicate. There has been little speculative interest and the market, shorn of its former leadership, has nevertheless shown bewildering fluctuations from day to day. For reasons which are not quite apparent, unless to discredit the new contract, some Banca and English refined tin has been put into warehouse and tendered to buyers. Experiments are being made with these qualities and it is hoped that they may be found serviceable to tinplaters and widen the choice of brands. Prices have varied between £193 and £199 for cash. The East has been a steady seller and American purchases have been good. English buyers have bought from hand to mouth, a cautious policy which the coal strike renders advisable.

## LEAD.

Average prices of soft foreign:

| Feb. 1912. | Jan. 1912. | Feb. 1911. |
|---|---|---|
| £15. 13s. 9d. | £15. 11s. 3d. | £13. 1s. 11d. |

Lead has been steady throughout the month. Great irregularity in arrivals has been brought about by difficulties in chartering vessels and by the Spanish floods, and in the absence of London stocks some high prices were realized for spot parcels. At the end of the month good supplies reached the Thames, but they were readily absorbed, as buyers' stocks were low. Prices show no signs of weakening.

## SPELTER.

Average prices of good ordinary brands:

| Feb. 1912. | Jan. 1912. | Feb. 1911. |
|---|---|---|
| £26. 6s. 5d. | £26. 9s. 11d. | £23. 3s. 10d. |

There is little of interest to record. Consumers hold aloof from the market, and the syndicate has tried to woo them by slightly lowering its demands. The response is not encouraging, and the coal strike is thought to interfere with fresh business. Imports from America are growing and substantial quantities have reached Liverpool during the month. The continental demand is good. The London dealers' price has remained about £26. 2s. 6d. to £26. 5s. during the month.

## OTHER METALS AND MINERALS.

Prices quoted on March 9:

SILVER.—26⅞d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£59 per ton.

NICKEL.—£170 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£27 10s. per ton.

QUICKSILVER.—£8. 5s. per flask.

MANGANESE ORE.—8½d. to 10½d. per unit (one per cent.)

IRON ORE.—Cumberland hematite 23s. 6d. per ton at mine. Spanish 21s. 6d. delivered in England.

PIG IRON.—Cleveland 50s. 3d. per ton. Hematite 64s. per ton.

WOLFRAM ORE—30s. per unit (1%).

# THE SALE OF TIN ORES

By O. J. STEINHART.

THOSE having to deal with the mining, smelting, and marketing of tin ores were naturally interested in the article which appeared in the January issue of the magazine, headed 'Selling Tin Concentrate,' and referring to Cornish practice. That a reform is desirable is obvious, but, on the other hand, the peculiar conditions prevailing in Cornwall as to the sale of tin ores must be taken into consideration. The industry is an ancient one, and old customs are still predominant.

To begin with, the 'draftage' of 3 lb. for every cwt. of concentrate sold, demanded by the Cornish smelters, is the outcome of an old custom. At times, when the ore was being weighed, the 'turn of the scales' was disputed, and apparently the buyer ultimately got the better of the miner, by demanding 115 lb. in lieu of 112 lb. Concentrate in Cornwall is sold wet, in which state the samples are taken and assayed, and a bid is made for the material in this condition. This, no doubt, is an undesirable practice for more than one reason, especially as it is well known that cases have occurred where water has been poured over the concentrate prior to disposal, in order to make weight. Producers who make a habit of this unfair practice will soon find, to their cost, that the smelter will remember it against them.

I had occasion to go into this question of the valuation of tin concentrate last year, and give herewith some of the data collected.

(1) CORNISH SMELTERS' CHARGES.—Including the 3 lb. allowance per 112 lb. demanded by the smelters, the total smelter's charge per ton of concentrate assaying, say, 65% Sn, amounts in round figures to £10. This charge necessarily varies slightly, as the buying of tin concentrate by the smelters at the ticketings is a competitive one; but it will be found that from £9 to £11 per ton generally covers the charges.

(2) CONTINENTAL SMELTERS' CHARGES.—As an example, I give the following price obtained in May 1908 for a concentrate assaying 71·4% Sn, dry assay, with the metal at £140. 2s. 8d. The Continental smelter paid 181·11 marks per 100 kilogrammes of concentrate, and as £140. 2s. 8d. per ton equals 280·27 marks per 100 kg. of metal, the smelting charge amounted to £9. 10s. per ton of concentrate. This is somewhat lower than Cornish charges, but as the ore was high-grade and pure, probably the Cornish charges would have been approximately the same.

Another smelter recently charged £12 per ton for concentrate containing about 67% Sn. The tin contents were paid for in full, the basis of the valuation being the average lowest price of either cash or three months tin, during the week following the arrival of the mineral. In this case, cash was paid, whereas in the previous example a three months' bill for value was given.

(3) AUSTRALIAN SMELTERS' CHARGES.—The Mount Bischoff Company (Tasmania), which undertakes custom smelting besides treating its own concentrate, makes, so I understand, the following charge: Smelting charge, £3 per ton, and a deduction of 2% from the assay to cover smelting losses. Thus for a 72% concentrate they return 70% tin, or 14 cwt. of metal per ton of mineral. A heavier deduction is made for concentrate under 70%. It must be observed, however, that this low total charge of under £7 per ton with tin at £190, is due to the great purity of the Tasmanian ores.

(4) STRAITS SETTLEMENTS SMELTERS' CHARGES.—As far as I can gather, the following is the charge made by the Straits Trading Company at Pulo Brani, which company handles by far the greater portion of the concentrate from the Malay Peninsula. The total deduction for concentrate assaying 70% Sn is about 2½%, and proportionately more for mineral at lower grade; for instance, with 65 to 67·5% material, 4% is deducted. From the weight of the dry concentrate in conjunction with the reduced assay-value thus obtained, the weight of metallic tin is calculated, and is paid for in cash at current rates, less a returning charge of from £2. 10s. to £3 per ton of ore. These figures are only approximate. Mr. H. D. Griffiths, manager of the Tronoh mine, gave more details concerning Malay smelting charges, in the *Mining Journal* of June 10, 1911, which may be summarized in the following lines.

With an ore assaying 75·6% metallic tin and including a deduction of 2·6% smelting loss, the total smelting charge is: with tin at £156. 6s. per ton, £8. 12s. 11d. per ton; at £176. 8s. per ton, £9. 2s. per ton; at £196 per ton, £9. 13s. 3d. per ton. In the case of lower-grade concentrate assaying about 68%, and with tin at £176. 8s. per ton, a deduction of 3·2 units is made, and the total smelting charge in such a case would vary from £10. 4s. to £11. 6s. 10d. per ton.

In looking at the various charges one point

must not be overlooked, that is, the cost of carriage of the concentrate, which may considerably modify the actual amount obtained by the mines.

Naturally, in comparing the smelting charges obtaining in different parts of the world, it must be remembered that the price realized for concentrate depends, apart from the percentage of metal, upon the absence of deleterious minerals and elements, such as sulphur, arsenic, wolfram, titanium, magnetite, etc.

As will be seen from the above, England is apparently the only country where tin ore and concentrate is sold without stating the actual tin content of the concentrate purchased. It is to be hoped that the day is not far distant when this obsolete and undesirable method of procedure will be relegated to the past. In all fairness, however, to the Cornish methods of selling tin ores, it must be borne in mind, that even with the present system, the smelter does not materially underpay the mine-owner when comparison is made with the procedure in other countries. This was shown on one occasion when an important Continental smelter endeavoured to purchase tin concentrate in Cornwall, but failed because his offer was not so favourable as the local one.

# DEEP MINING

By J. McCOMBIE.

DURING the past twenty-five years a great deal of attention has been given by scientific men to the genesis of ore deposits, and various theories have been propounded on the subject. Nevertheless, experienced mining engineers are still afraid to condemn a mine because its orebodies have a poor surface-showing, or to proclaim a brilliant future for a mine because the ore yields high assays on the surface, and therefore it is still a case of 'as you were' pending further developments.

The question now agitating the minds of the people interested in the future of the Ohinemuri goldfield, New Zealand, and giving trouble to mine owners elsewhere in the Dominion, is the possibility of payable ore being found beneath proved barren zones. As yet I have never seen, heard, or read of any mine or mines where the orebodies did not fluctuate as work was extended upon them, and in my opinion there is no law regulating the occurrence of either profitable or barren zones. The rich ore-shoot may trend to the north at an angle of 45°, or it may dip to the south at an angle of 25°, or it may go down vertically, but sooner or later a change of country rock intervenes, and then the valuable contents either increase, or they may disappear altogether. This generally occurs after the permanent water level is reached, and it continues through what may be termed the 'ebb-and-flow' water line. Theorists explain this by stating that according to the season the water line rises and falls, with long intervals between the changes. Thus the orebodies become decomposed and eventually leached, new orebodies being formed which have no valuable contents; hence the existence of barren zones.

Every experienced mining man must have observed that a change in the value of the orebody is nearly always coincident with an alteration in the character of the enclosing country rock, especially on the New Zealand goldfields. This is particularly noticeable where the brown andesite merges into the blue andesite, or vice versa. Instances have come under my own notice where lodes were valuable so long as they were accompanied by oxidized country, but without value as soon as the unoxidized country made its appearance in the deeper levels. Then again I have met instances where the opposite was the case, and the valuable mineral disappeared as soon as the enclosing country rock changed from blue to brown. Strange to say, there was little or no alteration in the general character of the lode itself, except that below the change of country it contained no ore. In cases of this kind the question presented to mine owners is, whether they are to continue developing in the hope of finding another zone of ore, or whether they are to throw up the sponge without further effort.

There are innumerable instances on record where profitable zones occur beneath barren zones, and there are also examples where barren zones have been found to continue until they have exhausted the patience and depleted the pockets of the shareholders. In matters of this kind reasoning by analogy is obsolete, and therefore experienced men accept no theories unless they are supported by something in the shape of substantial facts. I will quote two cases, one for and one against the theory that barren zones are always succeeded by profitable zones.

There was a time in the history of Bendigo, Victoria, when all the knowing men left the place in disgust because the outlook for the future was so gloomy. A hard zone of country had made its appearance at the bottom of all

the deepest shafts in the district, and profitable ore was conspicuous by its absence. In fact, all the mining experts concluded that Bendigo, as a goldfield, was finished, and the sooner they left the place the better it would be for them. Residing in the place, however, was one man who had faith in the possibility of finding ore again by sinking, and that man was the late George Lansell. Fortunately for himself he was possessed of the requisite capital to back his opinion, otherwise Bendigo might have been erased from the map of Victoria as a goldfield. Mr. Lansell continued sinking his shaft in the 180 mine through a belt of exceptionally hard country, at an enormous cost, till ultimately he struck a second zone of auriferous country, infinitely richer than the one near the surface. Thus, principally through the faith and perseverance of one man, who was regarded as an enthusiastic optimist, Bendigo was resuscitated, and it is the home of some of the deepest gold mines in the world today.

At Marysville, Montana, U.S.A., the Drumlummon mine was worked continuously for a great number of years with profitable results. Below the 400-ft. level the orebodies became small in size and poor in quality, and at the 800-ft. level several of them came completely to an end. From thence to the 1000-ft. level the whole of the lodes throughout the workings became poorer and poorer, until they would no longer cover the cost of breaking and treatment. At this juncture several leading mining men were called upon for their opinion regarding the future. The advice of this combination of wisdom was to continue sinking, because the lodes would be more than likely to become productive again. Sinking was then resumed and continued to a depth of 1600 ft. No ore of any value was discovered, and, during the progress of the work, nothing whatever was seen to indicate that the poor zone would not go down to unfathomable depths. Here are two notable instances which still leave the question an open one, and neither of them can be taken as affording an infallible rule. In this, as in all other things appertaining to gold mining, local conditions and circumstances—especially capital—go a long way to govern the case, and every mine or mining district has to work out its own salvation. Nothing short of actual exploration will reveal the future of any gold-mining venture, whether it be great or small, and the sooner we realize this, the sooner we shall drop theorizing and subject our deep-level schemes to a practical test.

# MAKESHIFTS IN MINING

By THOMAS PRYOR.

THE La Calixta property, a small gold mine in the development stage, was situated in the Republic of Colombia, South America, one-and-a-half day's journey by mule south of the town of Popayan, or six days by mule and one by railway from Buenaventura, the most northerly port of any importance on the Pacific coast of the country. Pack-mules, however, took about 15 days to do the journey, and in the wet season it was not uncommon for supplies to be on the road six weeks from Buenaventura to the mine. Including import duties, the cost of introduction of materials varied from $190 to $146 per ton of 1000 kg. The heavy cost of transport and the numerous delays on the road made necessary the use of several makeshifts on the mine.

Candles, for instance, were made from wax bought locally. This wax was called *cera de laurel*, but the shrub from which it came is a myrtle, *myrica cerifera*. Toward August the shrub produces a small berry or fruit. These are gathered and thrown into cauldrons of hot water. The waxy substance floats and is skimmed off. When congealed it is a dirty green colour, but after being re-melted and refined, it becomes nearly transparent.

The accompanying photograph shows a native woman making candles at the mine. The moulds are made of tin, and have a cup-shaped mouth, a cylindrical body, and a conical end with a small hole in it. The wick (a few strands of loosely twisted cotton yarn) is cut rather more than twice the length of the mould and is doubled over a small piece of stick. The free ends are then threaded through the hole at the end of the mould, the wick is drawn tight until the stick at the other end rests on the mouth of the mould, and the free ends are knotted, thus leaving the wick stretched in the centre of the mould. A row of moulds is then suspended as shown, and the molten wax poured into each in turn. A bamboo, split to form a kind of launder, is placed underneath to catch the drips. When cold, the knotted ends of the wick are cut off, and the moulds are thrown into a pail of warm water, the candle being readily extracted by pulling the small piece of stick at the mouth of the mould. The portion of candle corresponding to the mouth of the mould is cut off and thrown into the stock-pot for re-melting, and the candle is then ready for use. They last much

*MAKING CANDLES.*

*A MAKESHIFT SMITHY.*

longer if hung up to cure in a cool dry place. It is not economical to use a candle less than a month old; and the older they are, the harder and whiter they become.

The wax cost us from $1·80 to $3·50 per arroba of 25 lb. delivered on the mine, being usually bought at $2·20 per arroba. An arroba made about 220 candles; 40 cents gold was paid for making a hundred candles. The candles would thus cost approximately $1·40 per 100 (or say 12½c. per lb.), and were charged to the miners at $2·25 per 100, to allow for fluctuation in the cost of wax. Tallow or suet candles were scarce and cost about $4 per 100, and Price's small white wax candles cost about $5 per hundred.

There was a 3-stamp (250 lb. each) Fraser & Chalmers prospecting mill on the mine, driven by a belt from a wooden pulley on the axle of a 12-ft. wooden water-wheel made on the mine. In order to keep the water-wheel at a safe number of revolutions while driving the mill at 90 drops per minute, there was a large difference in the sizes of the water-wheel pulley and the mill pulley. This caused a great deal of belt-slipping, and consequent wear, as the belt was always wet; and had not the mill been a temporary one it would have paid to insert an intermediate shaft instead of trying to get the required speed in one step. The wear was so great that a rubber belt lasted only about 8 months; a leather belt was useless; and a Balata belt always slipped badly after the first month.

Finally belts were tried made of the *agave* or aloe fibre, locally known as '*cabuya*.' A photograph shows the primitive method of extracting the fibre and making the belt. A leaf is shown in the foreground. It is placed on a sloping board, and a boy removes the pulpy matter by scraping with a stick, leaving the fibre as seen behind the boy's head. The fibre is then plaited into a rope long enough to make a belt of the required length and width, the rope being doubled backward and forward until the desired width is attained, when the belt is firmly stitched together with string made of the same fibre. A belt 50 ft. long by 7 in. broad cost $6 and would last about 6 weeks under trying conditions. After the first stretching and wetting, these belts did not give anything like the same amount of trouble through slip as the imported belts. Belts of this fibre should answer well for the transmission of low powers under ordinary conditions.

For use at the outlying prospecting adits, makeshift smithies were made near their mouths, the Colombian miners being able to sharpen their own drills tolerably well. Another photograph shows one of these smithies. The bellows were made of wood, with sides of stout khaki cloth, if leather was not obtainable. The valves were of leather, or of wood with leather hinges. The nozzles were made of pieces of an old gun-barrel. The hearth was a rough table made of split bamboo, and covered with mud plaster. A low mud wall, through which the nozzle projected, was built between the hearth and the bellows to avoid charring the wood. The fuel used was charcoal which cost about 60 cents per sack. Oak (*roble*) makes the best charcoal. Excellent anvils were obtained by fixing worn stamp-shoes from the prospecting mill into a tree-trunk, as shown in the photograph. The men sharpened their tools while waiting for the smoke to clear after a blast. A makeshift smithy of this kind saved the expense of maintaining a boy to carry steel to and from the central smithy of the mine.

The Colombian workmen were usually quite orderly and peaceful, but occasionally on market-days in the village a man would drink too much *aguardiente*, or have too noisy a squabble with his neighbours. The daub and wattle huts were not strong enough to be used as lock-ups; and it was no punishment for a miner to be shut up in an adit, where he could steal rich ore. Finally, we made the stocks shown in the fourth photograph. These answered their purpose splendidly. If a man was inclined to be troublesome, he was hung up by both ankles, though after the first few days, this was rarely required, one ankle only being usually inserted. The stocks were fastened with stout padlocks. Two or three hour's detention in the stocks was generally found to be sufficient to humble the most quarrelsome fellow. Afterward, according to the gravity of his offence, he would be set to work for 2 or 3 days repairing the roads near the mine.

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**Copper in Scotland.**—The Shirvan mining company reports the discovery of a lode of copper ore at Kilfinnan near Loch Fyne, Argyllshire. The rocks in this district are pre-Cambrian and the ore is stated to be found in a crystalline limestone.

**Swiss Mountain Railways.**—The Jungfrau railway has now reached an altitude of 11,400 ft. As much of it has been driven in tunnels, there is not the same æsthetic objection to it that may be urged against other similar projects.

*THE VILLAGE STOCKS.*

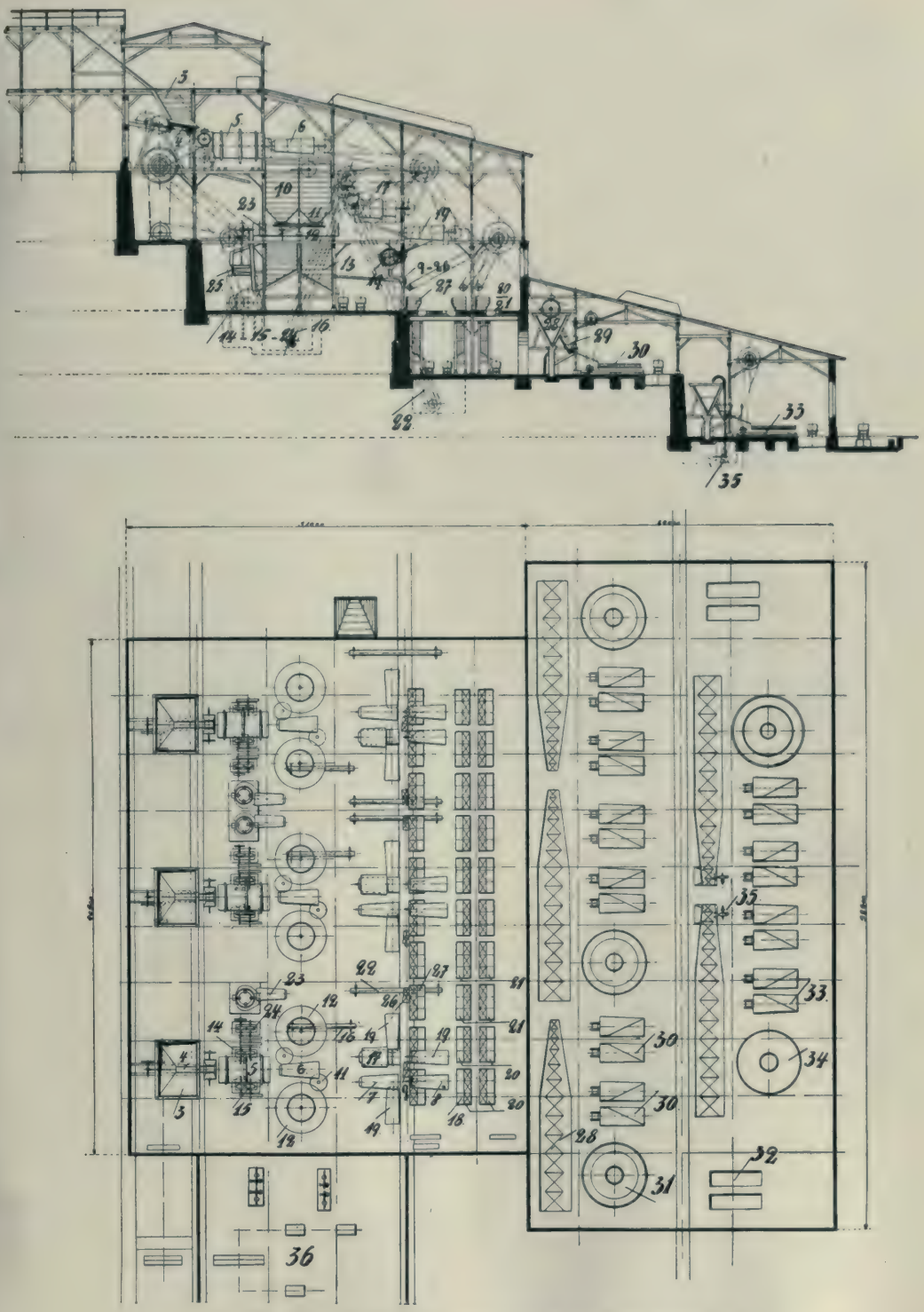
*MAKING A BELT.*

# CONCENTRATING BOLIVIAN TIN ORES

By an OCCASIONAL CORRESPONDENT.

REFERENCE has been made from time to time in the pages of the Magazine to the introduction of modern concentrating plants at tin mines in Bolivia. There are at present four or five modern plants at work. One was described by me a year ago, that was erected for Aramayo, Francke & Co. at Chorolque near the Argentine border. Particulars are now available of another modern illustration. This has been erected by the Humboldt Engineering company for the Compania Estanifera de Llallagua at a mine of that name 40 miles southwest of Oruro. The ore deposits in this district were discovered about 20 years ago and were worked for some years in primitive fashion. In 1899 General Pastor Sainz, of Sucre, bought up many of the properties and introduced improved methods of mining and concentration. In 1905 Mr. S. J. Patino, of Oruro, purchased the control and formed the present company. Mr. Patino also owns the Salvadora mines in the same district and has recently acquired the Minchin properties of the Compania Miniera de Uncia. Under his auspices the new Humboldt plant was erected and it started work in 1909. The mines are situated high in the mountains and are from 12,000 to 14,000 ft. above the sea. The tin lodes are associated with Tertiary igneous rocks that have penetrated the Devonian and Carboniferous formations. The upper parts of the lodes contain oxide of iron, and lower down the cassiterite is associated with pyrite, chalcopyrite, bornite, argentiferous tetrahedrite, blende, and wolfram. Very little tourmaline has been found.

The dressing plant is designed to treat 210 tons per day of 10 hours and it is divided into three units of 70 tons each. The first of these units has been erected and is at work. As will be seen from the illustration, the plant is built on the side of a steep hill. The ore is broken at the mouth of the mine and conveyed three miles by aerial tramway to storage bins at the dressing plant. From here it is carried in trucks to the hopper (*3*) and delivered by a mechanical feeder (*4*) to a washing trommel (*5*). Here the slime and clay are removed. The cleaned ore goes to trommel (*6*) where it is separated into two classes, measuring 50 to 35 mm. and 35 to 20 mm., and falls into corresponding bins (*10*). The fine sand and slime are carried away through a 4-mm. screen at the end of the washing trommel to another trommel (*7*) with 2½-mm. holes; the ore arrested here goes to the trommel (*8*) in the classifying department and the slime goes to a classifier (*9*). The coarse material in the bins (*10*) is fed on to picking-tables (*12*) measuring 4 metres in diameter. Here high-grade ore and waste are removed by hand and thrown into receptacles below. The ore remaining on the picking-tables is discharged automatically and sent to rolls; the 35 mm. going to rolls (*14*), 1 metre diameter, and the 20 mm. to rolls (*15*), measuring 0·7 metre diameter. From the rolls the ore is elevated (*16*) to a trommel (*17*) which has three sets of perforations respectively 20, 15, and 5 mm. where it is joined by the material from the trommel (*6*). The oversize goes back to the 0·7-m. rolls, and the ore from 20 to 15 mm. is sent to the jig (*18*), while the remaining ore is classified in trommels (*19*) into five sizes, 10, 6½, 4½, 2½, and 1 mm., the slime going to the classifier (*9*) already mentioned. The five sizes and the sand from (*9*) go to a series of jigs (*20*) and (*21*). The middling from these jigs is elevated to a trommel (*23*) where it is sized above and below 2½ mm., the larger going to fine rolls (*24*) and back to the jigs, and the smaller to a 'pendulum' mill (*25*), the latter machine being somewhat similar to a Huntington mill. The discharge from the pendulum mill passes a screen with 0·8-mm. holes and is classified at (*26*) to produce material that can be treated in jigs (*27*). The slime from (*9*) and (*26*) goes to spitzkasten (*28*), and thence through the mixing cone (*29*) to Humboldt tables (*30*), and a Bartsch round percussion-table (*31*) for the finest slime. The middling from these tables is re-treated on secondary Humboldt tables (*33*) and Bartsch table (*34*). The middling from the latter machines is returned by a pump (*35*). I am informed that the ore assays 9 to 10% of tin, and that the yield of concentrate is about 13 tons per day, averaging 63% metal. This shows an extraction of nearly 85% of the content. As already mentioned, the tin of the lower workings is accompanied by other minerals, and it has been found desirable to adopt roasting and magnetic separation in order to obtain a better quality of concentrate.



CONCENTRATION PLANT AT LLALLAGUA TIN MINE, BOLIVIA.

# PERSONAL

J. O. ARNOLD, professor of metallurgy in the University of Sheffield, has been elected a Fellow of the Royal Society.

H. B. BATEMAN is returning from Northern Nigeria.

R. T. BAYLISS sailed for South Africa on the 'Balmoral Castle' on March 2.

A. G. M. BEVAN left on February 26 for Siberia, to take charge of the operations of the Siberian Development Co.

HENRY BRELICH left London on March 5 for the Malay States.

DONALD F. CAMPBELL sailed for New York on February 15.

J. C. CARNE is visiting Papua for the purpose of examining the coal deposits on behalf of the Australian Government.

RICHARD E. CARR has left Cordoba, Spain, and is now in London.

E. W. CLIFFORD has been appointed manager of Modderfontein B mine.

B. I. COLLINGS has recently returned from Rhodesia.

WILLIAM CROSLEY is in London and will shortly return to Mexico.

R. H. CROZIER left Sydney for the Northern Territory of Australia to superintend diamond-drilling operations.

ARTHUR E. DRUCKER, of Seoul, Korea, was married to Minnie Barstow on February 14.

J. P. FULLER is home from Sumatra.

H. W. GEPP of the Amalgamated Zinc (De Bavay's) is in London.

JAMES GRAY has opened an office as consulting chemist at Johannesburg.

ALLAN GREENWELL, editor of the *Colliery Guardian*, is attending the meeting of the Canadian Mining Institute.

J. G. HAMILTON has been elected president of the Transvaal Chamber of Mines for the forthcoming year.

FRANK HARVEY, chairman of Dolcoath, is paying a visit to the Rand.

C. S. HERZIG sailed for Nigeria on March 13. He has taken offices in Salisbury House, London, E.C.

BERTRAM HUNT of San Francisco is in London.

L. H. L. HUDDART has returned from Northern Nigeria.

H. A. JUDD has been appointed manager for the Nassawara Tin Fields of Nigeria.

H. BRERETON KENT returned from Nigeria on February 24.

E. LANGLEY is now inspector of mines in the Kimberley district of South Africa.

G. F. LAYCOCK left for Asia Minor on March 10.

ERNEST LEVY is here from Canada.

ERNST LICHTENBERG sailed for Canada on February 23.

W. J. LORING has returned from Burma.

J. MALCOLM MACLAREN has concluded his visit to Copper River district, South West Alaska, and is now at Juneau.

RALPH MARTIN has resigned the management of the Modderfontein B owing to reasons of health.

T. D. MERTON is on his way to London from Australia.

RUDOLF MESSEL, president of the Society of Chemical Industry, has been elected a Fellow of the Royal Society.

JAMES MCEVOY is giving a course of lectures on coal mining at Toronto University.

CYRIL E. PARSONS has been inspecting the Skipper copper claims in the Gwelo district of Rhodesia.

REGINALD PAWLE and HENRY BRELICH have entered into partnership with offices at Balfour House, London, E.C.

ARTHUR L. PEARSE has returned to London from California.

MAURICE PERCIVAL has left for Nigeria on behalf of the Northern Nigeria Mining & Exploration Co.

L. H. RETALLACK has returned from Ecuador.

WILLIAM ROBERTS has returned to Cornwall from Egypt.

A. E. SAVAGE is here from Broken Hill.

BAINBRIDGE, SEYMOUR & CO. announce that as from March 1 D'ARCY WEATHERBE became a partner of the firm.

SPARKS & WILLIAMS have moved their office to 52 Queen Victoria Street, London, E.C.

HERBERT STRICKLAND has an office at El Paso, Texas.

E. C. VIGEON has returned to London from the Congo.

GEORGE WEIR has been elected president of the Mine Managers' Association, Broken Hill.

D'ARCY WEATHERBE, of the firm of Bainbridge, Seymour & Co., left London for Siberia on March 6.

WALTER WETHERED arrived in England on February 24 from Nigeria.

W. H. WOODHEAD, manager of the British Broken Hill mine, is in London.

C. H. WRAY has left for Northern Nigeria.

# DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

## A Simple Crusher for Samplers.

The Editor:

Sir — In your December issue I notice an article describing an apparatus used in South America for the preliminary crushing of samples. From its appearance I should judge it to be efficient. It is represented as a huge rocking muller working on an iron plate. Its great weight, however, limits its application.

I have found great satisfaction in using something of the same sort, of which the chief attractiveness to the travelling engineer is the fact that it can be improvised from the old iron generally found around the mine. I call this apparatus the 'hand-stamp.' I have found it much better than any other hand crushing device available. It is simply a large mortar and pestle except that the mortar is a flat plate. The pestle is like a cement worker's tamping tool, made smaller at the base so that a heavy blow may be struck. The ore is spread over the plate; then the operator steps on the plate if it is a large one, or straddles the plate if it is a small one, and pounds the ore with the stamp. I have discarded the manufactured crusher in favour of the hand-stamp on several occasions where both were at hand.

On a trip to Mexico my associate, Mr. S. A. Ionides, kept careful records of the times taken to crush a twenty-pound sample, first by the time-honoured method of single jack and rock mortar, and then by the hand-stamp, the same Mexican labour being employed in each case. The result was 8 to 1 in favour of the hand-stamp, and there was much less loss from flying particles.

The hand-stamp is illustrated in the accompanying photograph. It should weigh from 10 to 18 lb. and the handle should be 4 ft. long. A strong man can do great execution with a 20-lb. stamp, but the average man breaks more rock with one of 10 lb. weight.

To illustrate how a stamp outfit can be improvised from the average material on hand, I will describe a few I have made.

*A SIMPLE CRUSHER FOR SAMPLERS.*

(1) The stamp was made of an old blacksmith's swedge, which the blacksmith flattened out on the bottom and welded to a bar of drill steel. The mortar was a round flat casting which I found behind the mill. It was 2 in. thick and about 2½ ft. diameter. This being too small to catch flying particles, I got two cheese-boxes and made a retaining wall or ring which was lifted off when the sample was brushed up.

(2) The stamp was made of a pine pole fitted into the bottom of a mercury flask. The flask had been sawn in two by some industrious prospector. The mortar consisted of a turn-sheet 5 ft. square laid on top of a pile of rails. The ore was not very hard. A turn-sheet is apt to be rather thin for hard ore.

(3) The stamp was made of standard pipe-fittings. The bottom was a 3-in. cap. This

was bushed-down to $\frac{3}{4}$-in. pipe, a 4-ft. piece of which made the stamp-stem. The mortar was a large, hard piece of paving sandstone. No retaining was necessary on account of the size of the stone, but in spite of the fact that the stone was worn smooth it was found necessary to brush it energetically after each crushing to avoid leaving fine in its pores.

(4) The stamp was made of a discarded pump-piston to which a piece of pipe was fitted. The mortar was an old boiler-casting about 3 ft. square and $\frac{3}{8}$ in. thick, having the edges turned up on three sides. This was laid on some new grate-bars to give it stability, and in spite of the thinness of the material it lasted for the crushing of about 250 large, hard samples.

(5) The stamp was made from the foot of a small drift-bar of a stoping-drill into which a 4-ft. piece of pipe was fitted. The mortar was an ordinary bucking-board turned upside down. This mortar being small, a retaining wall was made of light boards, which was lifted off each time a sample was cleaned up. About $2\frac{1}{2}$ tons of very hard rock was crushed to the size of corn on this bucking-board without cracking the board. I think, however, that it would be wise to lay a row of new rails, or heavy timbers, under a bucking-board, if hard rock is to be hand-stamped on it. One might not have such good luck every time.

I have found the hand-stamp a very useful implement. Only a few mines have power sample-grinders, and of those that do, many are shut-down at the time the engineer wants to use the power.

GEO. J. BANCROFT.

Denver, February 5, 1912.

## Dredging for Gold.

The Editor:

Sir—Of all the branches of the mining industry, there is no question but what, in the last eight or ten years, that form of gold mining known as dredging has made the greatest number of advances. When properly conducted it certainly offers the safest form of mining investment, for in most cases the life of the property can be ascertained with accuracy. Ten years ago there may have been an excuse for some of the failures in the dredging business, but at this time they should be the exception. Having regard to the number of successful companies operating today it would be wise for prospective dredging companies to look into the methods employed by them, rather than entrust the preliminary and most vital part of the work to the first man who claims a knowledge of the business. Once a property has been properly investigated and equipped, nothing but rank mismanagement can spoil it.

With the prospecting devices now available a reliable determination can be made of the gold content and the extent of the dredgable area. The prospecting must be done with the utmost care, for upon this to a great extent the success or failure of the venture depends. It is surprising that any company should start work on a property concerning which they know nothing more than that there is gold at the place, on information gained from the local inhabitants that quantities of gold have been found in the vicinity. Local hearsay proves nothing; it only affords an excuse for thorough investigation. What it is absolutely necessary to ascertain is the accessibility of the property, water-supply, gold content per cubic yard, extent, depth to bedrock, nature of overburden, gravel, and bedrock, also characteristics of the gold. Each of these features has its distinct bearing on the type of dredge to be installed. When working in an enclosed pond large quantities of clay overburden are extremely detrimental to an efficient recovery of the gold. Hard bedrock makes it naturally difficult to clean-up the bottom, whereas a soft bedrock that permits of digging assures a thorough extraction. The nature of the gold, whether coarse or fine, granular or flaky, will determine the style of tables. These are a few of the vital points that must be considered, yet, as I have good reason to know, they are often entirely overlooked.

A gold dredge is practically complete in itself. Properly built and equipped, it does not need any expert labour to operate. Men of average intelligence, with a competent fitter to supervise the care of the machinery, are wanted.

One often hears lengthy discussions on the virtues of the California dredge as compared with the New Zealand and other types, with reference to their suitability to various parts of the world. It is not a question of California or New Zealand type; the point is to get a machine suitable for the work wherever it is, and a thorough comparison of conditions should be made before determining the requirements. A Californian likes a close-connected bucket-line working on spuds. The man from New Zealand wants the open-connected buckets working on a head-line. Both have their virtues, and a combination of the two might work out well for some other region. I have seen both types working under similar

conditions, that is, where large rocks and snags are encountered, and must confess that the close-connected type has my preference. When the tremendous increase in output of the close-connected type is balanced against the slightly increased power-cost some interesting facts develop.

Dredging machinery differs so widely from the ordinary that the usual rules of proportion in the design of the various details do not usually apply. Sudden shocks are numerous and varied, and the load is never constant. Excessive power and large factors of safety in the various members are absolutely necessary. The gritty water calls for carefully designed bearings. Protection of wearing faces, to save the body-structure, will lessen the high cost of replacements. Things wear fast on a dredge. Special attention should be paid in the design to allow of repairs being done quickly, as running time is one of the most vital features. A dredge is a complete plant in itself and when one piece goes, the whole thing shuts down, and it is all going out and nothing coming in. Practical experience has developed dredges, not theories or sets of rules, and men with experience at both ends of the game should be consulted when selecting a plant. The fact that the digging is easy does not necessarily indicate a dredge of light construction. I have seen few places where ample material in the make-up of the various parts ever went amiss. Shut-downs always mean a loss far greater than the cost of the extra metal that might have made the thing last a reasonable length of time.

It has often been a source of wonder to me why in many instances you see a dredge with about half the table-surface that there is room for. The simplest rule for table-area on a dredge is to put in all you can and then look for a chance to put in some more. If you think 500 square feet will do, and there is room for a thousand, put it in. It is the greatest safeguard against loss of gold. The screening device and water-supply should be in proportion to the digging capacity. A good water-supply well distributed is of the utmost importance. It is always well to have a little more than necessary, for you can check it if desired, but it is comforting to know you can have it when wanted. One fatal error, too often made, is the building of a dredge with a capacity for digging more than it can wash. This always results in a poor recovery, for the moment there is a blocking of the screen or overloading of the tables a loss of gold is bound to follow. These are simple facts, yet they are often overlooked. It is true that a great deal of this is a result of the fact that the designing is done by mechanical men without the supervision of one well versed in gold-saving, and the natural result is that though the general machinery may be good the whole is lacking in gold-saving efficiency.

Of the various forms of gold-saving my experience has been entirely with Hungarian riffles, and expanded metal with cocoa-matting. Personally, I am all in favour of the first. I know of no instance where the work done with expanded metal could not be done with riffles and there is a great deal of gold that riffles with mercury will hold that expanded metal never stops. Mercury is in any circumstance the ultimate medium for collecting the gold; therefore, why not use it first as last. It has been definitely proved that the riffle system with quantities of free mercury makes for a greater percentage of recovery than expanded metal.

SAMUEL J. WEIS.

Gold Coast, January 8.

## Tongkah Harbour.

The Editor:

Sir—I noticed in the February number of your Magazine that in reviewing the report of the Tongkah Harbour Tin Dredging Company, you state that "during the year, the fourth and fifth Werf-Conrad dredges had been put to work." Of the five dredges on this property, only two are by Werf-Conrad. The first, fourth, and fifth dredges were built by William Simons & Co., of Renfrew. The two latest dredges were specially designed for the work by Mr. M. T. N. Bluck, the company's consulting engineer.

DAVID CURRIE.

London, February 15.

## The Finance of a Mine.

The Editor:

Sir—I have read the series of articles on mine finance by Mr. M. H. Burnham. Such a subject embraces perhaps the most important phase of the art of mining, and any stimulus to its advancement should be highly appreciated by all concerned.

The duties of the mine-valuer are more exacting now than formerly, for the reason that good mines that are for sale are exceedingly scarce. When they do change ownership the price is invariably considerably in excess of the net value of the ore reserve. This condition, due to the law of supply and demand, has forced the examining engineer to put a

definite purchase-value on what must be regarded as 'future possibilities.' Mr. Burnham endeavours to associate definite mathematical laws with the appraisal not only of ore that can be measured, but also with the appraisal of future extension. I believe the use of such formulas is limited in practical application. Mines are never alike; the most that can be said, in even unique cases, is that they are similar. Also it is difficult in practice to find standard blocks of ore to which such formulas could be successfully applied. The consumption of such ore-blocks is also a matter of administrative policy, which may vary, and necessarily vitiates mathematical refinement in net estimation.

The appraisal of future possibilities by formulas is, in my judgment, attempting to measure conditions more or less abstract. The personal equation of the engineer in the shape of experience must necessarily be a dominant factor. Estimation of future possibilities would appear to be based only on inference. In my judgment the main inferential factors are five in number: No. 1, the character of the deposit in respect to past experience of the geology of similar deposits; No. 2, the size of the deposit in respect to length and width; No. 3, the question of secondary alteration; No. 4, the depth to which the mine has been worked; No. 5, the experience in the immediate neighbourhood of the persistence and continuity of orebodies at depth. Mr. Burnham's foot-slice system would appear to apply only to No. 4, without taking into consideration the others, which are equally important.

The relative magnitude of ore reserves in any particular mine is very much a matter of administrative policy. A small mill in combination with an energetic policy of development will result in a mine maintaining a large ore reserve. A large mill on the same mine accompanied by an ordinary development policy will result in an ore reserve proportionately reduced. It is, therefore, obvious that the same mine may be developed down to the same depth under two administrative policies as indicated and exhibit the same earmarks of persistence. Therefore, any method of appraisal of future possibilities that depends upon formulas would result in entirely different valuations of the same mine-bottom.

In the issue of the *Mining and Scientific Press* of September 16, 1911, I wrote a paper entitled 'Valuing the Future of Mines.' I covered substantially similar grounds. I believe I proved that any relative connection by mathematical laws between ore reserves and future possibilities to arrive at a compound appraisal of the whole is highly fallible. Endeavour was also made to show that the proportionate method advocated by Mr. J. H. Curle in 'The Gold Mines of the World' is a most seductive theory, but is as liable to overvalue future possibilities as to arrive conservatively at their appraisal.

My experience has resulted in the discontinuance of most formulas or rule-of-thumb methods in my practice as a valuating engineer. When representing a purchaser, an engineer should use his own judgment on the individual case presented. This judgment is mainly dependent on experience founded on a college training and natural business ability. The duty of the engineer generally resolves itself into a compromise between securing a client's money as far as possible on ascertained facts and simultaneously getting the best attainable speculative possibilities in respect of future development. Many important discoveries have been made by closely following the experiences of mines either adjoining or in the immediate vicinity of a property. Here again enters the personal equation. The recent important discoveries that have been made in Nevada in the course of the last two years reflect the greatest credit on the reasoning power and intelligence of those responsible for the discoveries. The ore-shoot of the Tonopah Belmont mine, which property is paying 100% per annum, has approached within 250 ft. of the side-lines of an adjoining property. The present face of this orebody is phenomenal in both width and value. Development work in the adjoining property has not resulted so far in finding commercial ore. This is owing to the fact that such work has been done in ground remote from the Belmont orebodies. There is no certainty that the ore-shoot referred to will extend through the side-lines into the adjoining ground. At the same time there is what can be regarded as an excellent speculative possibility that it will. In event of the adjoining property being for sale it would be impossible to use any formulas in appraisal. The personal factor would be dominant. The experience of the engineer in similar deposits would be of paramount importance. Success, or otherwise, would depend entirely on this, in combination with business ability. The latter qualification would appear to lead the engineer to advise that a small first payment, with subsequent payments increasing as they fell due, would be better business than a substantial

cash payment down, although the latter might be very much the cheaper in the end. Under different conditions a material reduction in purchase price by buying outright, as against a greater total price on time payments, would be better business.

These examples, in a limited and crude manner, show the varied conditions that cannot be computed by any process of measurement available to the valuing engineer in the practice of his profession and the limit to the practical application of formulas.

MORTON WEBBER.

New York, January 26.

The Editor:

Sir—I have read with considerable interest Mr. M. H. Burnham's series of articles in your magazine on 'The Finance of a Mine.' Among other things, he discusses the subject of allowance for risk in the determination of the present value of ore reserves. If I have understood him correctly, I believe he is fundamentally wrong in his application of the 'risk-rate' principle. Assuming that it were feasible to select a 'standard block' as a basis of comparison for determining the 'risk-rates' of other blocks, and that it were possible to know just when each block of ore would be worked, the use of the risk rate, as applied by Mr. Burnham in determining present values, is in my opinion wrong. I believe all formulas and calculations based upon the 'standard block' with its standard 'risk-rate' would lead to unreasonable results. This I will try and demonstrate.

On page 280 of the October issue Mr. Burnham says: "Any investment entails the assumption of a capital return, say, 3% as the rate realized from securities involving no risk, and a further rate as an allowance for additional risk, counting from the date of investment." The "further rate" is what Mr. Burnham calls the 'risk-rate.' As applied, the risk rate of any particular block of ore is added to the consol rate (3%) before determining the present value of its estimated profit. By giving the same risk rate to various blocks throughout the mine, it would appear at first sight that the same allowance had been made for risk, or for the possible shortage in profits below the original estimate.

This is not the fact, however, as will be seen from the following specific examples:

Assume, for instance, two standard blocks identical in every respect, each having the same gross value per ton and net profit, the first, Block A, to be worked one year hence, with the payment of profits delayed say two years from date, and the second, Block B, to be worked nine years hence, with the payment of profits delayed say ten years from date.

EXAMPLE (1), BLOCK A.—If P represent the estimated profit in this block, then 0·857 × P is the present value of this profit figured at the standard 8% rate (say 5% risk rate + 3% consol rate), with payment deferred two years. (See Inwood's 'Interest Tables', page 80.) The profit necessary in this block to give the same present value when figured at the consol rate (3%) would be 0·908 × P (that is, the amount of 0·857 × P for two years) at 3%. (See Inwood's Tables, page 66.) In other words, the actual profit from working the block could fall to 90·8% of the estimated profit and still be sufficient to pay the consol rate (3%) on the original estimate of present value.

The 5% risk-rate as used by Mr. Burnham, therefore, in this case, is equivalent to having made a 9·2% cut in the estimated profit before calculating its present value at the consol rate, 3%, or to having figured the present value of the estimated profit at 3%, considering it as an assured asset, and then having cut this figured value 9·2% for safety.

EXAMPLE (2), BLOCK B.—Proceeding as above, the present value of the profit P figured at the standard 8% rate with payment deferred ten years, is 0·463 × P, and the profit necessary in the block to give this same present value when figured at the consol rate (3%) would be 0·622 × P; in other words, the actual profit from working the block could fall to 62·2% of the estimated profit and still be sufficient to pay the consol rate (3%) on the original estimate of present value. The 5% risk-rate, as used by Mr. Burnham, therefore, in this case, is equivalent to having made a 37·8% cut in the estimated profit before calculating its present value at the consol rate, 3%, or to having figured the present value of the estimated profit at 3% considering it as an assured asset, and then having cut this figured value 37·8% for safety. We thus have the case of two standard blocks identical in every respect with the same assumed risk-rate and profit, and yet with greater different implied risks.

The above examples could be multiplied, assuming blocks of the standard dimensions with identical characteristics and estimated profits, but worked during different years, and by applying the same standard risk rate to each, the implied cut for safety would be different in every case. Should we consider blocks with larger risk rates, the variation in the

percentage cut would be much more marked. The following table was computed to illustrate this more definitely. The implied cuts in profits are there expressed as percentages of the estimated profit, and are shown for blocks with different risk-rates when worked at different times. By following any row from left to right, the cut which the corresponding risk rate implies is clearly shown. The variation for the different years is marked, especially for the higher risk-rates.

It would be reasonable, of course, to make some allowance for the fact that an estimate made today of the net profit in a block of ore might be subject to greater error the longer the working of the block be postponed, but an arbitrary cut such as the table shows, irrespective of the margin of profit involved, is certainly unreasonable. It is easy to imagine a great injustice in the case of a large risk rate applied to the estimated profit of a rich block of ore to be worked a few years hence. (Refer to table).

Another important consideration is that blocks with the same risk rate are not necessarily identical in every respect as was assumed in the table for purposes of demonstration. The gross value and profit in one might vary considerably from that of another. The effect of such variation is illustrated below. If two standard blocks were to be worked during the tenth year, for instance, the implied cut for safety in each case would be 37·7%. This would lead to unreasonable results in many cases. For example, should the first block have an estimated gross value of 40 shillings per ton, cost 15s. per ton, and profit 25s. per ton, and the second a gross value of 20s., cost 15s., and profit 5s., an actual error of 10% in the estimate of the gross value, and a 10% under-estimate in cost, would reduce the profit in the first case 22% and in the second 70 per cent.

Mr. Burnham's determination of present value would be a 20·1% under-estimate in the first instance, and a 107·7% over-estimate in the second. Under no circumstance, except by coincidence, would it be possible for both his estimates to be correct at the same time.

It appears to me therefore that the use of the 'risk-rate,' as applied by Mr. Burnham in determining the present values of the profits of individual blocks is fundamentally wrong, and that all the formulas and calculations based upon his 'standard block' with standard risk-rate would lead to unreasonable results.

ROSS B. HOFFMANN.

Oakland, California, January 23.

| Risk Rate % | + | Consol Rate % | Year during which block is worked, or number of years deferment in payment of profit. 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 16 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | The implied percentage cut in the estimated profit before calculating its present value at consol rate 3%, or the percentage cut for safety in the present value of the estimated profit figured at the consol rate of 3 per cent. | | | | | | | | | | | |
| 3 | + | 3 | 2·8 | 5·6 | 8·3 | 10·8 | 13·4 | 15·8 | 18·2 | 20·5 | 22·8 | 25·0 | 36·8 | 45·3 |
| 5 | + | 3 | 4·6 | 9·0 | 13·3 | 17·3 | 21·1 | 24·8 | 28·2 | 31·6 | 34·7 | 37·7 | 53·2 | 63·0 |
| 7 | + | 3 | 6·4 | 12·3 | 17·9 | 23·1 | 28·0 | 32·6 | 36·9 | 40·9 | 44 7 | 48·2 | 65·1 | 74·9 |
| 10 | + | 3 | 8·8 | 16·9 | 24·3 | 31·0 | 37·1 | 42·6 | 47·7 | 52·3 | 56·6 | 60·4 | 77·3 | 85·7 |
| 15 | + | 3 | 12·7 | 23·8 | 33·5 | 41·9 | 49·3 | 55·8 | 61·4 | 66·3 | 70·6 | 74·3 | 88·6 | 94·2 |
| 20 | + | 3 | 16·3 | 29·9 | 41·3 | 50·8 | 58·8 | 65·5 | 71·1 | 75·8 | 79·8 | 83·0 | 94·2 | 97·6 |

The Editor:

Sir—The economics of mining finance is a subject that has been too little discussed by mining engineers, and therefore Mr. Burnham deserves credit for the series of articles published in this magazine last year. His emphasis of the risk-rate serves a particularly good purpose, in that it brings forcibly to the attention of engineers the necessity of making due allowance for the risk connected with all mining operations. It would seem, however, that the risk comprises a number of other factors not brought out by the author, and due to the economic conditions attendant on the exploitation of any ore deposit. No mine is ever developed so thoroughly as to satisfy the engineer who is asked to sample and value it; consequently there is always an amount of risk involved in the engineer's estimate of ore. All capable engineers make allowances for the risk involved in mining operations, but usually express that risk in a simpler form than that recommended by Mr. Burnham. An engineer is usually required to value the mine in terms of the profit in the ore reserve; but it seems to me that the author is rather inclined to mix the functions of a mining engineer with that of a mining financier. The engineer, it is true, is occasionally put on a board of directors, usually not for his finan-

cial ability but to guide the board in his capacity as mining engineer. Were he to attempt to "face the issue fairly and certify not only to the working capital but to the amounts going to the vending and promoting interests," he would not only find that his employers had different, though perhaps just as sound, ideas on the subject, but in the vast majority of instances, in treading unfamiliar ground, he might show ignorance and render himself ridiculous. We must be impressed by the fact that under ordinary circumstances men with a strong commercial instinct will not study a profession, and further that the financial organization of any company is for the most part beyond the engineer's control. His services are usually requisitioned after such organization is complete.

I think also that Mr. Burnham attempts too much when he would have the engineer regulate the share value of a company, which is usually a fictitious figure depending almost entirely on stock-market conditions.

In a case known to me, an engineer examined a property and reported to his principals that it had a value between a million and eleven hundred thousand pounds sterling. His principals, however, proceeded to do business on a basis of over two million pounds. There can be no two opinions that the engineer had completely performed his function as an engineer in reporting the net profit, and was powerless to prevent his principals from selling it to the public at more than double its real value.

Another point, purely financial, to which I take exception, is the low rate of interest allowed, namely, that of Consols. Why invest in mining enterprises and assume all the risk adherent thereto, when the interest to be derived is not greater than can be obtained from the premier security. For notwithstanding all Mr. Burnham's arguments, the risk-rate is a hypothetical factor due to the ability of each individual to make proper allowance for all the adverse conditions that may arise.

Mr. Burnham, in discussing block calculations, states that the engineer is confronted with the question of the depth of the enrichment perpendicular to the sampled surface (see Article II). Except in the case of copper mines where the lowest level shows a change from the oxidized to the unaltered ore, the problem becomes of moment only in one particular instance to be mentioned directly. With the copper mine the depth of impregnation is usually determined by an inspection of the winzes. In a gold mine however, accepting the theory that there is always a zone of enrichment, where the bottom level shows the same grade of ore as the workings above, or where the bottom level shows a higher grade of ore, then the question of how deep the ore may be expected to extend becomes one of great moment in valuing the property, especially as it must by force of circumstances be included in the probable ore, and usually comprises the total amount of probable ore allowed. No amount of mathematics can replace the engineer's judgment. Were that not so, then anyone able to properly sample an orebody could value a mine as correctly as the ablest mine valuer.

The author I think attempts too much by mathematics. No doubt mathematics serve a useful purpose to the engineer, but, in the question of mine valuation, more depends on the personal equation of the engineer than on any mathematical equation ever invented, and for this reason we cannot discard "our old uncertain nomenclature of probable ore." It would be much to the point to be able to calculate the probable extension of an orebody by a mathematical formula. In the past, various attempts have been made to express the probable extension in depth of an orebody, in terms of the shoot length, but no engineer has had the hardihood to take any one of the various formulas as a basis for purchase, except so far as to give an idea of prospective value, and then only under exceptionally favourable geological conditions.

We cannot discard probable ore as a factor in mining valuation, and we cannot lay down any hard and fast rule, because every ore deposit from a valuation standpoint becomes a problem which must be solved on its own merits. As there are an infinite number of cases possible, an infinite number of rules would be required.

In Article III, the author states "Where the total present value is paid to the vendors of a mine, it may be safely said that either the mine was over-valued by the engineer, or the financiers neglected the very elements of their work, etc., etc." I do not agree with these premises at all. It does not follow that an engineer has over-valued a mine because its total present value has been paid. They are distinct propositions. Further, very few mines can be bought nowadays at anything like so low a price as their total present value. Despite the scoffing manner in which the author speaks of engineers in this connection, not only financiers but engineers as well, are ready to capitalize the future possibilities of

a property to the extent of 30 to 40% of the purchase price.

The flotation of the Buena Tierra mine by such a conservative and well managed concern as the Exploration Company, is a recent illustration. In this case the total profit in the estimated available ore reserves amounts to only 68% of the capitalization, which is equivalent to saying that the directors, two of which are among the most capable and successful engineers in the country, are willing to stand sponsors that the mine will produce not only the remaining 32%, but interest on the capital meanwhile, plus an additional amount as a reasonable profit to the shareholders.

Mr. Burnham's 'economic shoot' would be useful were it practicable, but in the class of deposit, represented for instance by the Buena Tierra, or in any other deposit of irregular dimensions, where a pinch or swell may occur at any moment, or where a floor may cut off values entirely, the only guide is experience. It is true that in cases of fissure veins or even of replacement deposits, a unit for the calculation of the profit which may be expected from probable or possible extension in depth is assumed by the engineer, but it is done, not by a study of company construction, but by geological construction and the mine data.

It is a truism to say that the "measure of an ordinary mine" is "the profit in sovereigns to be expected from each foot in depth as the proved ore-shoots are exhausted," and "is a more comprehensive measure of the probable future magnitude than the ore blocked out." What is 'expected' is still only an expectation, whereas the ore reserve, within the limits of the subject under discussion, is a positive figure and an absolute index of existing conditions, besides forming the basis of the whole business. Further we are prone to ask, how can we calculate the extension of ore in depth except on the basis of ore reserves?

C. S. HERZIG.

London, February 29.

## About Exploration Companies.

The Editor:

Sir—Most mining men and engineers, in the course of their professional work in every part of the world, are constantly brought into contact with prospective mines, practically undeveloped, yet bearing all the 'ear-marks' of future profitable mines. It is seldom that the professional engineer has either the time or the funds to devote to the business of exploiting, developing, and financing such meritorious prospects; therefore, when they encounter such in their travels while on other errands, they must either bid the possible embryo bonanza a fond farewell, or else make a note of its favourable and unfavourable characteristics and submit it to the head of some exploration or development company that is supposed to be engaged in this class of business. The chances are that he will be informed by the manager of such a company that they are interested only in the examination and purchase of developed mines with well defined and profitable orebodies.

Is it not a fact that none of the larger and richer exploration companies will consider any prospective mining enterprise, excepting in cases (like Porcupine) where surface ores are sensational? They want all possible risks to be taken by the original discoverers or operators, and are willing to pay a premium for the elimination of such risks as are inseparable from the development of even the most hopeful prospects. This premium is usually paid in the form of a payment for undeveloped and possible ore in such productive mines as may be purchased under advice of their engineers. For example, I note that during the past year one prominent American mining exploration company examined some 330 different mining propositions, and purchased two of these and negotiated for a third. One wonders what the figures are on the other side of the prospecting and examination ledger; whether the cost of examination of some 300 projects, in all parts of the world, which are supposedly developed propositions, is not far greater than could be consistently expended by half-a-dozen competent engineers in doing primary and conclusive development work on a large number of prospects whose surface showings are as good as, if not better than, that which obtains at the larger, more developed, and productive mines of the class to which the 300 were supposed to belong. Taking an average of $1000 for each examination of the 300, we have a total expenditure of $300,000 to disburse before we can make up our minds to pay, upon the advice of our engineers, $500,000 for one property, $650,000 for a second, and $1,500,000 for the third, selected from a bunch of 300. In a nut-shell the idea occurs to me and may be stated in this way: would not this $300,000 paid in examination expenses accomplish more profitable results if properly spent in the work of prospecting for, or of bonding undeveloped surface showings, and doing thereupon sufficient work to determine their merits or demerits at depth? Surely $300,000 would do

a lot of prospecting and preliminary development, and, if such work resulted favourably in some cases during the year, such successfully matured prospects could be purchased for a few thousand or even a few hundred dollars, as against the hundreds of thousands necessary to acquire proved mines with profitable ore reserves. Scattered through the west of the United States and in Canada and Mexico are countless such tempting surface showings, as yet unproved because of lack of capital. The same condition also obtains in every other continent of the world.

The large exploration and mining companies are frank in their expression of desire for the acquisition of meritorious mines, and spend fortunes annually in examination of many supposedly such, submitted to them from all quarters of the globe. As a matter of fact it is a good deal of a merry-go-round, in which the engineers of the different large syndicates take turns in examining the same properties for their respective clients. Will a review of the subsequent history of such high-priced acquisitions always make delectable reading for some of their purchasers? Are not some of these large companies finding that extreme conservatism is expensive? Do they not realize that developed mines with prolific ore reserves that are for sale are getting more uncommon each year?

It is not to be assumed for a moment that, even with the best of judgment, technical knowledge, and experience to aid him, any mining engineer can do development work on say ten different surface-showings or prospects, and have such work result in the demonstration of profitable mines in each case. We all know that such an engineer will be doing well if he can develop only two good mines from his selection of ten prospects. And these two mines, thus obtained, are quite likely to cost much less all told than the $300,000 expended in the examination work alone of a great development company each year.

It seems to me that one of the principal reasons that the development of prospects has proved so generally unrenumerative is because such work has been left by the large, experienced operators to the inefficient speculator and promotor, or to the small fry, the mining camp store-keeper and the small city merchant. This latter class have done their best, but through their inexperience and because of their limited capital they seldom succeed in making a mine out of a prospect, and therefore the business and the district fall into disrepute. The big experienced operators and exploration companies thus conclude that that branch of the mining business is too risky, and so confine themselves to the conservative examination and re-examination of second-hand mines that can show a reserve below the surface. If the same amount of money and engineering talent that is now devoted to the examination, equipment, and rehabilitation of developed, second-hand mines, were expended in the business of developing good surface showings and prospects, mining would once more become an industry instead of a poker game for unscrupulous promoters and careless speculators. It is true that most of these larger exploration and mining companies keep one or more experts travelling around reconnoitreing for possible bonanzas, yet it is seldom that a good prospect will appeal to this class of engineer, for the reason that it is easier to draw a thousand dollars a month looking for a sure thing than it is to hold any kind of a job after recommending the development of a surface-showing that did not 'make good.'

It will be noted that I am arguing for less conservatism and more mining.

PERCY WILLIAMS.

Vancouver, B.C., February 2.

## The Non-technical Press on Mining.

The Editor:

Sir—Your reference to the inaccuracies which appear in the daily Press regarding mining, and your recent criticism of the *Sunday Times*, seriously draws attention to one of the crying evils of the day. The non-technical but energetic mining reporter, in his efforts to secure information, usually acquires his knowledge at the fountain head, which, in most cases, means the people interested in pushing the shares of their own companies. Not only have the daily newspapers committed offences of this kind, but also the more serious financial weeklies.

There is a striking difference between the character of your analyses of mining companies' operations, and those of the non-technical periodicals. This difference shows how important it is to have a technical knowledge of the business in order to properly value the statements issued by the companies themselves. It is part of our business as engineers to protect the investor, large or small, from wilful or ignorant mis-statements. Largely through ignorance, the non-technical Press sands sponsor for palpable inaccuracies which any experienced engineer can detect at sight.

One of the most curious illustrations of in-

accuracy appeared in the *Statist* of February 17, in a discussion of the Cam & Motor mine. Here we find the editor taking a great deal of credit upon himself and his special commissioner for devising "a quite novel method of showing the position of, and variation in width of the lode at the different levels." Further he says: "In the plan our special commissioner devised, the earth is supposed to be transparent, and the lode, as it exists at different levels, can be seen *in situ* from a balloon." The illustration given in the *Statist* showing the plan 'devised' by the special commissioner, is that old and thoroughly familiar method of showing the relative position of different levels, which has been used ever since mine surveying has been in existence, and which is commonly known as the 'plan of the mine,' each level being distinctively hatched or coloured to distinguish it from any other. Were the editor of the *Statist* an engineer, he would not, with such evident pride, claim novelty for a device so old.

CAROLUS.

London, February 24, 1912.

## The Profitableness of Mining.

The Editor:

Sir — Estimates of the profitableness of mining are sometimes based on the figures of the total registered capital. Such estimates, however, are misleading. The rate of return on the total registration calculated over the last 20 years, would not provide even for the redemption of the capital, but a highly profitable result on the really necessary capital can be shown. The total registrations are excessive for the following reasons:

(1) Registration Inflations.—(*a*) Registrations include companies that do not go to allotment and many others that are private enterprises. It is recorded in connection with our most active year that the nominal capital of the companies which printed, circulated, and advertised prospectuses amounted to only £34,000,000 out of £107,000,000 registered at Somerset House. (*b*) Ashmead states that "companies that have been in existence five years or more, as first registered, would be few indeed. In this way much, if not most, of the capital registered in the companies as they went to allotment has been duplicated, part triplicated, and part still further magnified. (*c*) As with reconstructions, amalgamations also have had a material effect in duplicating already registered capital. (*d*) A considerable proportion of the registered capital of existing companies remains as unissued scrip; for the Rand, say 6%, and for Rhodesia say 15%. (*e*) Against these inflations of registration figures there is the comparatively insignificant figure due to the fact that a small percentage of registered capital may have been sold above par.

(2) Unjustifiable Flotations. — (*a*) The mighty array of wild-cat promotions. (*b*) The frequent practice of flotation of mere prospects with capital applicable to full-blown companies, individual cases often exceeding £100,000. Many of these ventures, if justifying any exploration work at all, could have been condemned on an expenditure of 1% to 5% of the registered capital. (*c*) Incompetent selection of prospects, over-estimation of developed ore, carelessness in the detection of salting, etc. (*d*) Inadequate working-capital causing total abandonment, loss of interest and expenses pending and in respect of reconstruction, and the adoption of inadequate plant and uneconomical working policy. The properties that eventually reach the stage of production are but few when compared with the number of original flotations.

(3) Other Causes.—(*a*) Maladministration due to ignorance of technical considerations, to indifference, and to market operations of directorates and financial corporations. (*b*) Purchase price; if one company in thirty were proved to be profitable, the proportion of the total issued capital received by the vendors to that actually spent in profitable working would be enormous. (*c*) Sound finance would allow of the purchase and equipment of profitable mines with money on which say 5% interest plus redemption only had to be paid. In this way the money applied in the removal of the inherent risks would reap its full reward. Theoretically this is the work and policy of development corporations. (*d*) Overcapitalization. Ashmead found from the registrations at Somerset House that on an average only 25% of the capital registrations was set aside for issue as working-capital and this 25% included the reserve shares. Moreover, this percentage included the sounder companies operating in Great Britain, principally in respect of coal, iron, and quarries. If these had a working-capital of 60% those operating abroad could have had only 20%.

Can it be proved that mining abroad under sound conditions and even with all its unavoidable risks, is incapable of returning 20% as well as providing for redemption of the capital actually required?

T. H. B. WAYNE.

London, February 26, 1912.

# PRÉCIS OF TECHNOLOGY

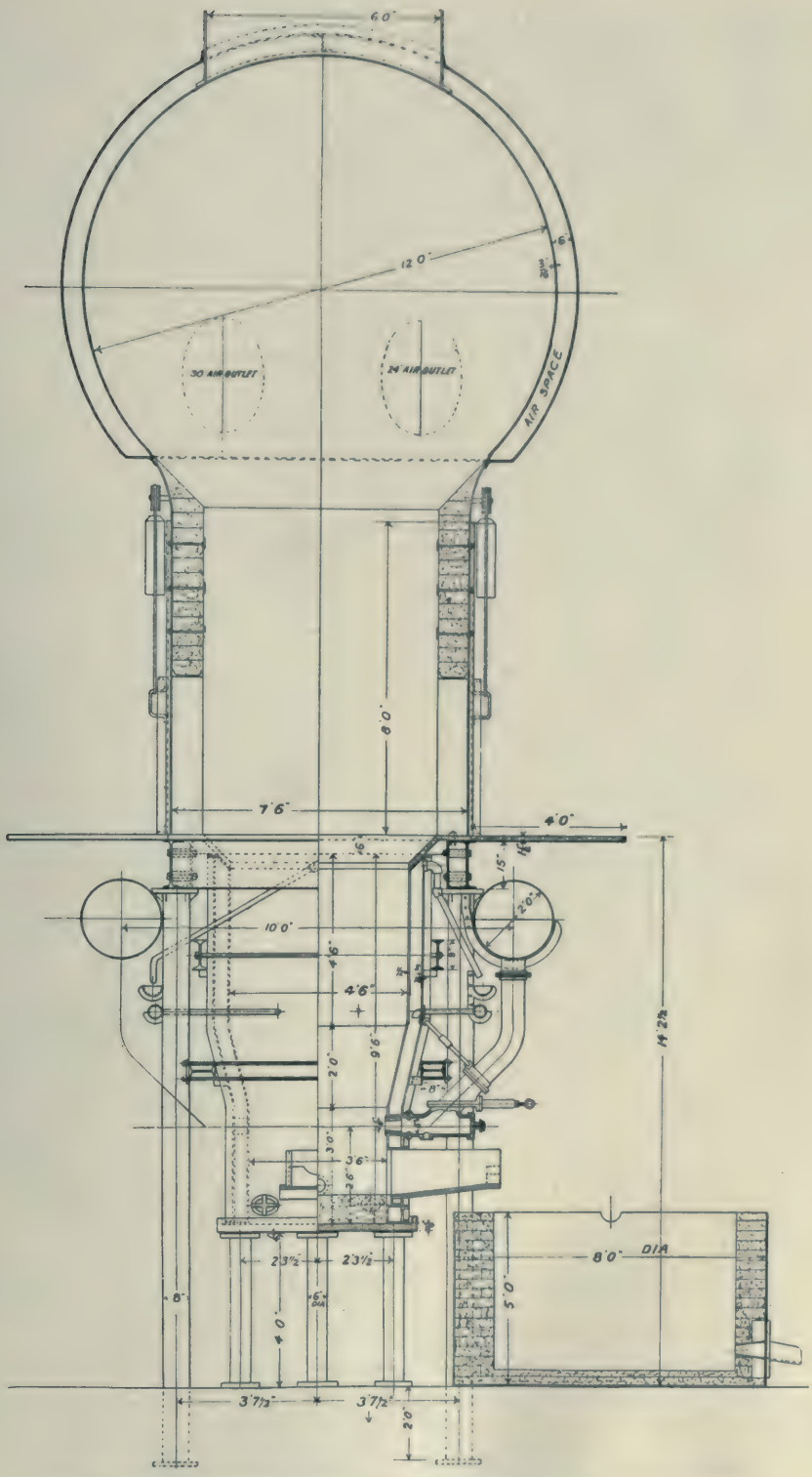
**Norwegian Iron Ore.**—The *Iron & Coal Trades Review* for February 2 contains an article by A. Udhang on the Sydvaranger iron ore mines. These are situated at the extreme north of Norway (as indicated in the accompanying map taken from F. H. Hatch's 'Mineralogy'), more northerly even than the better known Lapland mines. The deposits were discovered in 1900 and were first actively exploited in 1907. The present plant was put in operation early in 1910, and the full capacity will be reached during the coming summer when the output will be 500,000 tons of concentrate. The ore is a low-grade magnetite containing about 35% iron and 45% silica, with less than $\frac{1}{10}$th of 1% of titanic acid, phosphoric acid, and sulphur. It is found in the igneous rocks in the manner characteristic of Scandinavian deposits. The Bjornevands mine is the most important of the properties belonging to the company. Here the deposit is 300 ft. thick on an average and the reserve is calculated at a thousand million tons. The mining is conducted by open-cut. Blasting is done on a colossal scale, and steam shovels load the broken ore into cars, which carry it to gyratory breakers. After passing the latter, the ore is taken by train 5 miles to the port of Kirkenaes on the coast, where it is crushed in jaw-breakers and subsequently in ball-mills in a wet state, to be reduced to 20-mesh. It then goes through Gröndal wet magnetic separators where a concentrate averaging 56% iron is produced. This concentrate is then sent to tube-mills for further comminution and the product passed through another set of magnetic separators. The final product contains 69% iron, with less than 4% silica, less than ½% each of lime, magnesia, and alumina, and only 0·006% phosphorus and 0·015% sulphur. This fine material is briquetted in the Gröndal press, some of this work being done on the spot and the remainder at the ultimate destination in Germany. Though plenty of water-power is within a short distance, it cannot be utilized, as the falls are on the boundary line of Norway and Russia, and coal has to be used for generating the electric current.

**Herman Frasch and Sulphur.**—In 1906 the late Sir William H. Perkin founded a medal, in commemoration of the jubilee of his discovery of the first aniline dye, to be presented yearly in America to some one who had achieved success in the field of chemical industry. This year the choice has fallen on Herman Frasch, who has both scientifically and commercially done excellent work in removing sulphur from petroleum, and in mining native sulphur in Louisiana. *Metallurgical and Chemical Engineering* for February contains a full report of the speeches made at the presentation ceremony. Mr. Frasch's work has entirely revolutionized the world's sulphur industry and his discoveries in connection with the refining of petroleum had an almost equally important effect on the utilization of unmarketable oils. A review of his work is therefore of general interest. Mr. Frasch, a Bavarian by birth and education, went at an early age to America where he soon identified himself with the petroleum industry. In 1885 he removed to London, Ontario, where he made a study of the Canadian oils that, owing to the presence of sulphur compounds, were unsuitable for illuminating purposes. Not only was the smell highly objectionable, but the flame was smoky and the products of combustion charged with sulphurous acid. Mr. Frasch found that the objectionable sulphur compounds had a strong affinity for metallic oxides and that in particular copper oxide gave excellent results when introduced during the process of distillation. The sulphur combined with the oxide to form sulphide of copper, which at intervals could be conveniently removed. On roasting, the recovered oxide could be used again. This process was subsequently adopted by the Standard Oil company and applied throughout the United States. After having achieved great success in petroleum refining, Mr. Frasch turned his attention to the Louisiana sulphur deposit, and won even more fame in this connection. As far back as 1865, a bed of native sulphur contained in dolomite had been struck at a depth of 1000 ft. in Calcasieu district, Louisiana, while boring for oil, but as the bed was overlain by a thick layer of quicksand, all attempts to raise it to the surface by mechanical means proved futile, and one company after another ended in bankruptcy. In 1891 Mr. Frasch undertook to raise the sulphur in molten state. He sunk a 10-in. pipe to the deposit, and continued the well through 200 ft. of the deposit by means of a 9-in. drill. He then sunk a 6-in. pipe from the surface to the bottom and inside this again was placed a 3-in. pipe. Suitable perforations and provision for valves and tight joints were made. Water heated to 335°F was then pumped down the 6-in. pipe and this proved sufficient to melt the sulphur and to force it up the central 3-in. pipe. This sulphur was run into an enclosure surrounded by vertical boards, and as it did not take long to solidify, the stack could be made of any extent and height. A great many difficulties arose in connection with the drilling of wells and raising the sulphur, and Mr. Frasch gave details of these and of the methods of surmounting them. Pro-

gress was slow and success was not always certain, but eventually in 1904 the production was so great as to supply all requirements in the United States, 200,000 tons, and to permit of an export to France. The subsequent history in connection with the working agreement with Sicilian producers need not be recapitulated here. The company conducting operations at Calcasieu is called the Union Sulphur Co., and it not only prosecuted the development of the deposit, but has also built a railroad to the coast and docks at Sabine Pass. As a rule six wells are in operation at any one time, and each will deliver 450 tons of sulphur 99% pure per day. The plank bins are 50 ft. high and when full will hold from 75,000 to 150,000 tons of sulphur. The planks are subsequently removed and the block is broken by blasting and the sulphur loaded directly into cars. At the meeting when the medal was presented to Mr. Frasch, A. F. Lucas also gave an account of other sulphur-bearing and salt-bearing oilfields in the southern states of America.

**Lime-Roasting of Galena.**—At the February meeting of the Institution of Mining and Metallurgy, C. O. Bannister read a paper describing laboratory experiments undertaken with a view of ascertaining the nature of the reactions in the Huntington-Heberlein, Carmichael-Bradford, and Savelsberg processes, in which lime or lime compounds are used for the purpose of hastening the desulphurization of galena. It will be remembered that five to eight years ago the theory of this group of reactions received much attention from metallurgists, but seeing that more recently other metallurgists found lime to be unnecessary, and that more modern plant and applications of the process have replaced the original ones, the reactions in connection with lime-roasting are not now of the same direct practical importance. None the less Mr. Bannister's experiments and deductions are of considerable value in the domain of research work, and he has been able to provide information in connection with the reactions of galena and lime that puzzled many metallurgists, Percy included. Mr. Bannister commences his paper with a succinct account of the three processes, and of the various theories advanced, and he pursues his inquiries on lines similar in the main to those of W. M. Hutchings. It will be remembered that while Huntington & Heberlein used lime, Carmichael & Bradford employed sulphate of lime, and Savelsberg carbonate of lime. In Mr. Bannister's first experiment, he took a galena concentrate averaging 78·56% lead, 11·79% sulphur, 2·2% silica, 2·24% iron, and 1·98% zinc. He made a mixture of 80% of this and 20% quicklime and heated it in a muffle furnace by gas, raising the temperature gradually and taking records by the pyrometer. He found that between 180° and 260°C there was a small evolution of heat due to burning sulphur. At 560° a considerable evolution of heat took place, corresponding to the glow observed in roasting. Another evolution of heat was noted at 745°, but not sufficient to make any brightening of the charge. At 800° a second large evolution of heat took place, causing another glow. Mr. Bannister proceeded to examine the charge as regards increase or decrease in weight during the heating, and found that until the first glow was reached there was a loss of weight of about ¾%. After the first glow the weight had increased by rather over 5½%, and after the second glow by between 13 and 14%. On chemical examination, it was found that these gains were due to the change of small proportions of the lime into sulphate. Tests made with a view of ascertaining whether calcium sulphide was formed, as supposed by many investigators, proved that after both glows this compound was not present. Similarly the existence of peroxide of calcium, originally surmised by Huntington & Heberlein, was disproved. The assay of the charge after the first glow was: lead sulphide 28·3%, lead sulphate 7·3%, lead oxide 28·7%, lime 16%, sulphate of lime 10·4%. After the second glow the figures were: lead sulphide *nil*, lead sulphate *nil*, lead oxide 56%, lime 6·2%, sulphate of lime 29·5%. It will be seen that after the second glow the whole of the sulphur remaining in the charge is in the form of sulphate of lime. A second series of experiments made by Mr. Bannister were with a mixture of the galena with 20% of silica, and two glows, but not strong ones, were recorded at 700° and 850°. After the second glow the charge contained 51% lead sulphate, 22·7% lead oxide, and 1% lead sulphide. In his experiments with the Savelsberg process he found that the glows were erratic and apt to be local in the charge, and that with the Carmichael-Bradford process the course of events was similar to that with the galena-silica charge, showing that up to 800° the sulphate of lime acts merely as a diluent and has no chemical effect. The reactions above 850% in the various roasts and the part played in them by silica are not in dispute, so Mr. Bannister did not enlarge on them at length in his paper. In fact H. O. Hofman's researches into the action of sulphate of lime at the higher temperatures already covered part the ground. Mr. Bannister analyses the results of his experiments by the aid of curves of temperatures, and is able to deduce the nature of the reactions according to their known endothermic and exothermic characteristics. His paper is a lengthy one and we are able here to give merely the outline of his objects and of his principal results. We discuss certain aspects of the paper elsewhere, and indicate the possible application of the researches.

**Blast-furnace for Zincy Copper Ores.**—The *Mining and Scientific Press* for February 10 gives information and a working drawing of a blast-furnace designed by S. E. Bretherton for the purpose of treating copper ores that contain much zinc. The modern developments in connection with the design of blast-furnaces, namely, the greater height of the column and the greater pressure of the blast, are only suitable for comparatively clean copper ores, and with zincy ores it is advisable to carry a low burden above the tuyeres and to have an extremely hot top. Without such a modification the incrustations would form rapidly on the walls of the furnace. In the design shown on the opposite page, it will be seen that Mr. Bretherton has introduced several novel features. In the first place the top is greatly enlarged, with the object of reducing the speed of the effluent gases, thus allowing much of the dust to fall back instead of being carried away. In the drawing this enlarged part is fitted with an enclosing shell, so as to form an air-chamber used for preliminarily heating the blast and for decreasing the temperature of the charging floor. This part of the design is not due to Mr. Bretherton, who considers that owing to the resistance to the conduction of heat on the part of the incrustation its efficiency as a method of heating the blast is small. The height from the centre of the tuyeres to the top of the charge is 7 ft. The bosh starts a few inches above the tuyeres and continues for a height of 2 ft., and thence upward the walls are perpendicular. This arrangement is made because the smelting zone is restricted to quite a short distance from the tuyeres, and it is advantageous to have the weight of the charge carried by the bosh so as to maintain a free circulation of the blast between the tuyeres.




*BRETHERTON'S BLAST-FURNACE FOR SMELTING ZINCY COPPER ORES.*

**Treating Zinc-Lead Sulphides.** — *Metallurgical and Chemical Engineering* for February contains notices of new processes relating to the extraction of metals from zinc-lead sulphides, invented by E. A. Ashcroft. Mr. Ashcroft's patents cover modifications of the sulphur-chlorine displacement process with which his name and that of James Swinburne were first identified a number of years ago. He does not now attempt to treat the raw ore, containing gangue as well as the sulphides, but confines himself to the final lead and zinc concentrates obtained by jigs, tables, and flotation plant. The object of his patent therefore is to save to the producer the zinc and silver which is lost to him under the present terms of the contract for the sale of the concentrates to the lead and zinc smelters. The new patents cover a large amount of ground, showing how lead may be removed from both lead concentrate and from zinc concentrate, and how the chlorine may be produced and regenerated. In removing lead from zinc concentrate the latter is treated with fused zinc chloride or a mixture of this with sodium chloride. The reaction is such as to form chlorides of lead and silver, and of any other metal such as antimony, iron, and manganese, together with zinc sulphide. The chlorides are removed and treated electrolytically for the recovery of the metals, while the zinc sulphide, both original and residue, is available for any method of treatment desired. In treating lead concentrate, it is possible to electrolyse direct by dissolving the lead sulphide in lead chloride. The zinc and the gangue float on the top of the molten bath and may be removed by skimming. The inventor describes methods of recovering the silver and for dealing with the chlorine, sulphur, and their compounds.

**Absorption of Gold by Battery-Plates.** —At the December meeting of the Chemical, Metallurgical, & Mining Society of South Africa, G. H. Stanley and M. Thornton Murray read a paper describing experiments undertaken with a view of ascertaining to what extent gold is absorbed throughout the entire thickness of battery-plates, and also by the walls of the cast-iron retorts. The plate examined came from one of the mills of the Crown Mines, and had been in use for twelve years. Its thickness was 0·13 to 0·14 in., and it had been sweated and scraped, but not scaled, before leaving the mill. A piece of it was taken and carefully flattened, and divided into seven layers, 0·02 in. thick, by means of a planing machine. Care was taken that the action of the cutting tool should not transfer gold from one layer to another. These layers were assayed for gold, mercury, and lead, and the results are given in the following table:

| Layer No. | Gold % | Mercury % | Lead % |
|---|---|---|---|
| 1 | 10·48 | 9·39 | 0·085 |
| 2 | 0·0166 | present in all | 0·084 |
| 3 | 0·00505 | cases but in | 0·080 |
| 4 | 0·0084 | amounts too | 0·053 |
| 5 | 0·0041 | small for | 0·097 |
| 6 | 0·0145 | determination. | 0·089 |
| 7 | 0·0018 | 1·89 | 0·104 |

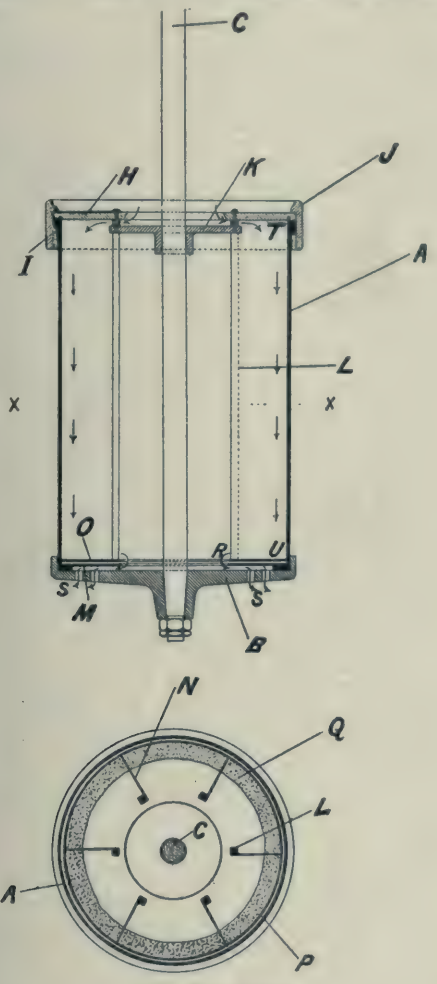
The average gold content throughout the seven layers was 1·21%. It will be seen that nearly all the gold was contained in the first or top layer. An examination was then made made metallographically of a section cut across the plate, and comparison was made with a similar section from an unused plate. The results obtained indicated that the amalgam had penetrated microscopic crevices and blow-holes in the structure of the plate. Similar examinations of the cast-iron retorts showed that gold was absorbed in appreciable quantity to a depth of $\frac{3}{16}$ in. from the interior surface.

In the discussion which followed the reading of the paper, W. R. Dowling gave the results obtained when recovering the gold from six tube-mill plates at the Simmer East mill. The amalgamated surface of each plate measured 12 ft. by 4 ft. 7 in., the total area being 328½ sq. ft. They had been in use 2½ years, and 42 days had elapsed since the last steaming. On steaming, 1221 oz. amalgam containing 318 oz. gold was removed. The plates were then scaled in the following manner. They were first heated over a wood fire so as to expel the mercury, the heat being just sufficient to char sawdust thrown on them. They were then removed, and while still fairly warm brushed with strong hydrochloric acid. After standing overnight, they were brushed with a saturated solution containing equal quantities of saltpetre and sal ammoniac, and heated over a bright wood fire. The scales that rose with this treatment were removed by scraping. The scale was melted with a flux of borax, manganese dioxide, and sand, and the bullion obtained contained 73·62 oz. gold. The same scaling process was repeated, and the second scraping yielded only 2¼ oz. gold. Afterwards, an assay was made of the plates, and the result showed the presence of only 1·16 oz. These results confirm those of Mr. Stanley, and show that very little gold is contained in the plates at a depth unattacked by a single scaling operation.

**Gee's Settler and Concentrator for Slime.**—At the meeting of the Royal Society of Arts held on January 24, William J. Gee described his centrifugal machine, originally invented for the purpose of rapidly settling china-clay, and more recently proposed to be applied in concentrating metallic slime. The machine is to be put in operation within a short time by a company recently formed for the purpose of working a china-clay deposit in Cornwall, but as applied to the concentration of metallic slime it is only as yet in the experimental stage. The machine as applied to setting china-clay slime consists of a vertical cylinder (*A*) revolving at a peripheral speed of 100 to 200 ft. per second. Inside are vertical vanes (*N*) held in place by the rods (*L*), and removable liners (*P*). The slime is fed at the top, and the coarser and heavier particles are caused at once to fly to the periphery and build themselves into a wall. As the water gradually passes down the sides, the finer particles range themselves to the periphery. The water also forms itself into a wall, and when its internal surface comes to the edge (*R*) of the bottom plate, it commences to discharge through the orifices (*S*). The rate of feed and of revolution are so adjusted that the effluent is quite clear. After a time the machine is stopped, the liners (*P*) and the adhering slime removed, and other liners put in their place. The cakes of slime may be divided into as many grades as desired, it being remembered that the particles are largest at the upper end and finest at the bottom end. The inventor claims that the classification of china-clay is done more efficiently than in the usual 'drags' and pits, that the removal of water is more complete, and that the time occupied is greatly reduced. The high velocity of rotation is a disadvantage and involves the use of special foundations and bearings. The fact that the working is intermittent may also be considered as against the process, not because of the actual time lost, but on account of the labour required.

When applying the principle to the concentration of

slime, a different motion is required. The inventor makes the vanes independent of the shell, and revolves them in the same direction and at rather a higher speed. The illustrations given below show the construction. The separation of the mineral from the gangue could not be effected at all unless the feed is accurately sized, so that the finer the slime the better. The difference in the speed of the vanes and cylinder causes a washing effect at the point of deposition, so that the particles of lower specific gravity are kept in suspension and are eventually removed with the effluent water. Many adjustments will be required, namely, the speed of the cylinder and of the vanes,

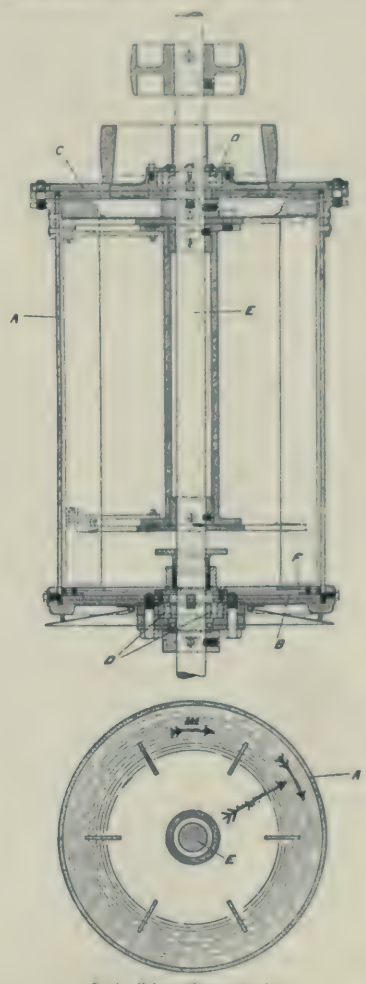



*Gee's Slime Settler.*

the distance of the vanes from the periphery, and the rate of feed. In carrying out the process, the feed would be stopped when a sufficient amount of concentrate had accumulated, and clean water substituted so as to remove all the gangue still in the cylinder; afterwards the concentrate is removed by retarding the revolution of the cylinder but not of the vanes. If all these delicate adjustments can be easily made, and if not too much skilled labour is required, the process may prove applicable to the treatment of tin or copper slime; there is plenty of room for improvement in present practice.

# CURRENT LITERATURE.

**Top-Slicing under Gravel Overburden.** — In a paper recently read before the Lake Superior Mining Institute and reprinted in the *Mining and Engineering World* (Chicago), W. A. McEachern described the method of recovering the upper part of an iron ore deposit underneath an overburden of gravel 130 ft. thick. The deposit had been worked at lower and safer levels. From the top of these, rises were cut upward and a system of top-slicing laid out. A layer of 5 ft. of ore was left below the gravel, so that as caving took place, the gravel should not mix with the ore.




*Gee's Slime Concentrator*

**Internal-Combustion Air-Compressor.**—*Engineering* for March 1 describes an air-compressor, designed by G. Matricardi, Italy. There is only one piston, moving freely, on one side being driven by the explosive charge, and compressing the air on the other.

**Aerial Ropeways in Bolivia.**—*The Engineer* for March 1 contains a description of an aerial ropeway in Bolivia connecting the Acero Cruz and Yanasella mines with the dressing plant at Ingenio Felix. The elevations of the two mines are 16,900 ft. and 16,800 ft., and that of the mill 14,150 ft. The lines are on the Pearce Roe system.

**Oxygen in Cyanide Solutions.**—In a paper published in the *Bulletin* of the American Institute of Mining Engineers for February, T. H. Aldrich describes an electrolytic plant used for generating oxygen in connection with the cyanide process. This consists of a battery of lead plates placed in the barren sump, and consuming 15 amperes when treating 40 tons of slime per day. It is found that the time of treatment and the consumption of cyanide are both greatly reduced.

**Removing Iron from Pulp.**—The *South African Mining Journal* for January 27 describes a new application of the Caldecott classifying cone at the Simmer & Jack, where it has been adopted for the purpose of removing metallic iron from the battery pulp and the tube-mill pulp. It has for long been a constant source of annoyance that the iron abraded in the stamps and tube-mills passes round the tube-mill circuit a great many times before being reduced sufficiently to pass the classifiers. By the interposition of cones, not set for too fine an overflow, the heavier iron particles can be made to pass away in the underflow. The latter is then sent along a belt through a magnetic separator, and the iron extracted. This removal of the iron has the additional advantage of being beneficial in the subsequent cyanide operations.

**Cyanidation in Colorado.**—In *Metallurgical and Chemical Engineering* for January, H. C. Parmelee describes the new custom plant of the Hudson Reduction Co., Idaho Springs, Clear Creek, Colorado, where continuous decantation with Dorr thickeners is used in connection with the cyanidation of tailing from the concentrators.

**Slime Treatment.**—In the *South African Mining Journal* for January 27, William Bettel describes experiments made for treating the old pyritic slime at the Orion dump.

**Wood's Flotation Process.**—In the *Engineering and Mining Journal* for January 27, Henry E. Wood, of Denver, describes his flotation plant, intended primarily for the concentration of molybdenite. The crushed ore is fed dry upon the surface of water, and the film of sulphide is carried continuously across the tank and removed by a travelling belt that emerges from underneath the surface of the water.

**Graphic Methods for Concentration Results.**—At the February meeting of the Institution of Mining and Metallurgy, H. K. Picard described a graphic method for showing the results of concentration tests.

**Dwight-Lloyd Sintering Plant.**—*Metallurgical and Chemical Engineering* for February contains an illustrated description of the Dwight-Lloyd straight-line sintering furnace used in connection with lead ores at Salida, Colorado. It gives a detailed account of the plant which we described briefly in our issue of August 1910.

**Smelter Assays.**—At the February meeting of the Institution of Mining and Metallurgy, A. T. French presented a paper describing combination methods of estimating the contents of ores and slags.

**Lead Analysis.**—In *Metallurgical and Chemical Engineering* for February, B. Woiciechowski describes the method, used at the Lumen Bearing Company's laboratory at Buffalo, for rapidly depositing peroxide of lead on a rotating gauze anode.

**Assay of Cyanide Solutions.**—In the *South African Mining Journal* for February 3, William Bettel describes a method of determining gold and silver in cyanide solutions, combining the cuprous salt and lead acetate-zinc methods.

**A Tantalum Mineral.**—The *Bulletin* of the Imperial Institute, December 1911, contains a notice of an occurrence of struverite in the Kuala Kangsar district of Perak, Federated Malay States, a short distance north of Ipoh, Gopeng, and Tronoh. This mineral has previously been found only in Piedmont in the north of Italy. It belongs to the tantalite group and contains a large constituent part of titanium. The percentage of tantalic oxide is estimated by analysis at 36%.

**Queensland Coal.**—The *Queensland Government Mining Journal* for January contains an official report on the Mount Mulligan coalfield north of Chillagoe and Herberton.

**The Geology of Kalgoorlie.**—The *Proceedings* of the Australasian Institute of Mining Engineers, Vol. 5, No. 2, consists entirely of a paper by C. O. G. Larcombe on the 'Geology of Kalgoorlie.' This is a valuable monograph of over 312 pages.

**Bloemhof Diamonds.**—The *South African Mining Journal* for December 23 contains an article giving full particulars of the operations north of Bloemhof in connection with diamondiferous gravel.

**Rea Mine, Porcupine.** — The *Canadian Mining Journal* for January 1 contains a history of the Rea gold mine, at Porcupine, written by T. H. Rea.

**Low-Pressure Steam-Turbine.** — In the *Mining and Engineering World* for January 13, George E. Edwards describes several installations at American mines of low-pressure turbines using exhaust steam.

**Briquetting Iron Ore.**—The *Iron and Coal Trades Review* for January 19 contains an article on the Grondal briquetting plant as applied to the preparation for the blast-furnace of the iron residue from pyrite after the expulsion of sulphur for acid manufacture and the extraction of copper by leaching. The instances quoted are at the Cardiff works of the Tharsis company and at the Hebburn works of the Bede Metal & Chemical Co.

**Magnetic Separator.**—*The Electrical Review* (London) for December 29 contains a description of Marcus Ruthenburg's magnetic separator for use in connection with ore concentration.

*Copies of the original papers and articles mentioned under 'Precis of Technology' and 'Current Literature' can be supplied on application to The Mining Magazine.*

# BOOKS REVIEWED

OBSERVATIONS ON THE WEST OF ENGLAND MINING REGION.—By J. H. Collins. Cloth, octavo, 700 pages, with many illustrations. Published by the Author. Price 21s. For sale by *The Mining Magazine*.

This book is nominally part of the Transactions of the Royal Geological Society of Cornwall, and is an amplification of a series of papers presented by the author to that institution during the years 1890 to 1897. It may be described as being primarily a discussion of the science of ore deposits with illustrations taken from Cornish occurrences, and secondarily as a complete account of the ore deposits and mines in Cornwall, going back as far as records serve. We may say without fear of contradiction that nobody living has so complete a knowledge of Cornish geology as Mr. Collins, and few people have so wide an aquaintance with the views and theories of the leaders of geologic thought of both the past and the present day. It will be disconcerting to some of the younger gener-

ation of economic geologists to find, from the perusal of this book, that John Woodward, William Borlase, and William Pryce in the eighteenth century had propounded the now generally accepted conclusions as to the origin and development of ore deposits: the great fundamental conceptions of the universal permeability and solubility of rock-substance; its constant transference in solution or by vaporization from one situation to another; the importance of fissuring and faulting in the provision of suitable loci for those natural concentrations of widely and sparsely distributed mineral substances, which alone in most cases are of economic value; the important part played by eruptive rocks in supplying new stores of metalliferous material; and the indications afforded by faulting as to the relative ages of fissure veins and vein deposits.

The book has come into our hands only a short time before going to press, and we have not had the opportunity of preparing the considered review which it deserves. We shall discuss it more in detail on a future occasion. In the meantime we predict for it a wide circulation among three classes of readers, namely, the economic geologists, those interested in Cornwall, and the prospectors in other lands where the experience of the author in connection with the indications of tin in lodes will be of inestimable service.

GRAPHICAL SOLUTION OF FAULT PROBLEMS. By C. F. Tolman, Jr. Flexible covers. 43 pages, illustrated. San Francisco: *Mining and Scientific Press*; London: *The Mining Magazine*. Price 4s. 6d.

In this little book of close on 50 pages of text and drawing, the author goes fully into the representation of fault movements by graphics. The origin of faults is not discussed, nor is any division of faults into classes undertaken; moreover faults for convenience in graphic demonstration are treated as geometrical planes, so that displacement by dikes is not considered. The nomenclature of fault movement, however, is put clearly with the aid of drawings, so that little ambiguity of terms is possible.

It is noteworthy that the functions of the lode-planes are so little referred to by the author in defining these movements. The actuality of fault movement is that the lode-plane is disturbed thereby, and the best description of such movement is in terms of the functions of the lode-plane or the mine workings. Beyond this, the greater part of the book is occupied with considerations of the methods of projection and the actual graphical solution of several fault problems, some more simple, some more complex, the resulting impression being that the subject is followed further than it could be by the ordinary mining engineer, who, however, is glad to feel that somebody is giving it the attention which it deserves, and who hopes that useful generalizations therefore will come down to him. The problems discussed in detail are a selection from those given in the laboratory courses in structural geology in the School of Mines of the University of Arizona.

S. J. TRUSCOTT.

MINERALOGY. By Frank Rutley. Eighteenth edition. Cloth, small octavo, 270 pages, illustrated. London: Thomas Murby & Co. Price 2s.

As we do not like to speak disrespectfully of an old and valued friend, we write this review of the new edition of Rutley's 'Mineralogy' with a feeling of keen regret. In earlier days the book was without a rival as a concise statement of the mineral species, their occurrence, and the methods of utilizing them for commercial purposes, and its price, two shillings, brought it within the reach of the humblest student. But it is now hopelessly out of date, and the memory of Rutley would have been better served by relegating the book to the historical shelf along with Lyell's 'Principles,' Murchison's 'Siluria,' and Percy's 'Metallurgy,' and to cease its publication. The reader who wishes for information about the distribution of the minerals and ores and about the methods of extracting metals from the latter will only be befogged by referring to its pages. The instances of the occurrences refer to long-forgotten Cornish and other English mines, or to European and American districts of earlier days. For example no mention is made of Indian and Russian manganese deposits, and under rhodonite the interesting occurrence at Broken Hill is not included. The tellurides of Colorado and Kalgoorlie were discovered long after the book was written, and the metallurgy of gold has apparently stood still at amalgamation. The notes on the fire metallurgy of copper are confined to the old Swansea practice and no intimation is given of the application of the blast-furnace. We might hope to find in so old a book a reference to John Hollway's pioneer work in connection with the use of the converter in copper metallurgy, but this reference is missing. It will surprise recent investigators to read that at Alderley Edge in Cheshire "the cupriferous sandstone is treated with hydrochloric acid." But it is uncharitable to pile on the agony by giving further proofs of the antiquity of the book.

GEOLOGY OF THE LAKE SUPERIOR REGION. By C. R. Van Hise and C. K. Leith. Quarto, 641 pages, with many illustrations and maps. Washington: United States Geological Survey. Price $2·50.

This truly monumental monograph will take front rank among the many valuable publications of the United States Geological Survey. Its scope includes two of the great occurrences of ore in the world, namely, the copper deposits of the Keeweenaw peninsula and the iron ores of Minnesota. It is noteworthy that the ground covered is not confined within the political boundary of the United States, but that the Canadian side also receives due attention.

THE DATA OF GEOCHEMISTRY. Second edition. By F. W. Clarke. Octavo, 780 pages, illustrated. Washington: The United States Geological Survey.

When this book, on the chemistry of geology, originally appeared in 1908 it was soon recognized as one of the most valuable compilations ever made, and a second revised edition is proof of its appreciation by geologists. It is issued as Bulletin 491 of the Survey. To give even an outline of the contents would occupy more space than we have at our disposal. Suffice it to say that information is collected together with regard to the chemical characteristics of gases, liquids, salts, rocks, and mineral compounds as known in nature. The number of references is prodigious, and the presentation of the facts and views is done with great terseness and wise discretion.

THE NIGERIAN ALLUVIAL TIN FIELDS. By Hubert A. Meredith. Pamphlet, 40 pages. London: Purbrook & Eyres. Price one shilling. For sale by *The Mining Magazine*.

This little book gives in concise form a general outline of the geological, mining, and economic conditions of Northern Nigeria, together with details of the individual companies working there. The first edition was published in December, and since then two revised editions have appeared, the object of the author being to keep the information and statistics thoroughly up-to-date.

THE MINING INDUSTRY OF MEXICO. No. 2 : State of Hidalgo. Compiled and edited by F. Gonzalez, A. Grothe, and L. Salazar. Quarto, paper covers, 36 pages, with illustrations and maps. London : *The Mining Magazine*. Price 3s.

In our issue of August last we gave a notice of the first volume of this interesting series of books on the mining industry of Mexico, that is being prepared by the authors with the official recognition of the republic and of the various states. The present volume completes the review of mining in Hidalgo. The first chapter refers to other properties at Pachuca other than the more important ones described in Vol. I. The second chapter deals with Zimapan and the last with Jacala. The next volume will describe the mining district of El Oro.

APPLIED ELECTROCHEMISTRY. By M. de Kay Thompson. Cloth octavo, 330 pages, illustrated. New York : The Macmillan Co. Price 9s. For sale by *The Mining Magazine*.

This book is the basis of a course of lectures on applied electrochemistry delivered in the Massachusetts Institute of Technology, and it contains a general survey of a wide field of industry. It is difficult to crowd within a comparatively small book sufficient information on each application to satisfy the reader, or even to barely mention many of these applications, especially when both the theory and the practice have to be considered. The subjects include electroplating, electrolytic deposition and refining of metals, electrolysis of water and of alkali chlorides, electric batteries both primary and secondary, the electric furnace as applied to the production of carbides, carborundum, etc., electrometallurgy of iron and steel, fixation of atmospheric nitrogen, manufacture of ozone, and electro-analysis. The author draws liberally on German literature and goes so far as to quote the German translations of English and American books instead of referring his readers to the more convenient originals. The electrolysis of alkali chlorides and the manufacture of chlorates receive undue prominence as regards space, but we miss any reference to the masterly paper by du Faur on the process for making chlorine at Mount Morgan, the best practical account ever published. Nor is any reference made to the electrolysis of fused salts. We are sorry to find no mention of the electric smelting of zinc ores, a subject much to the fore that should provide a large field of inquiry to the scientific investigator. Some of the statements are open to question and cause some uneasiness to the inquirer. For instance it is said that zinc deposited electrolytically has been shown to protect iron more thoroughly than the zinc surface produced by dipping.

COALFIELDS AND COLLIERIES OF AUSTRALIA. By F. Danvers Power. Cloth octavo, 420 pages, illustrated. Melbourne and London : Critchley Parker. Price 25s. For sale by *The Mining Magazine*.

This is the first book devoted to Australian coal that has ever been published, though of course many articles and papers have appeared in the technical Press and in the transactions of scientific societies. The fact that it is written by Mr. Danvers Power and published by the proprietor of the *Australian Mining Standard* is sufficient to warrant its reception with respect. The author describes in detail every productive mine, beginning naturally with those in New South Wales. The State mine in Victoria receives conspicuous notice, and full particulars are given of the coalfields in Queensland, West Australia, South Australia, and Tasmania. At the present time the economic conditions in connection with capital and labour in the Australian coal mines and coal trade are attracting universal attention, so this book will prove acceptable to those who desire to obtain the necessary data. But we are bound to confess that the book is not quite up to the modern standard of technical literature, though it may be up to the Australian Mining Standard. The illustrations as a rule have little to do with the matter in hand, and are mostly uninstructive pictures of patent apparatus, such as water-gauges for boilers, oil-separators for feed-water, automatic weighing machines, smoke-stacks, railway locomotives, etc. These and others have been chosen in a perfunctory and quite aimless manner. One good map of Australia with the coalfields marked thereon would be more than worth the lot. We should like also to have seen a chapter on the economics of local coke manufacture as applied to lead and copper smelting.

THE MINING MANUAL FOR 1912. By Walter R. Skinner. Cloth octavo, 1376 pages London : Walter R. Skinner. Price 15s. For sale by *The Mining Magazine*.

This wellknown year-book is now in its 26th year of publication, and in writing a review of it we can only repeat what we have often said before, namely, that as a directory of mining companies registered or known in England it is one of the indispensable publications of the City of London. For the benefit of those who, by reason of their unfamiliarity with London finance, are unacquainted with the book, we may say that it contains particulars of all mining companies that form the basis of London operations, their capitalization, dividends earned, objects in view, directorate, engineering staff, etc. The information is always up-to-date, and the absence of errors in so great a mass of figures and facts reflects the care and devotion of the compilers.

THE MINING YEAR-BOOK. Edited by A. N. Jackman, with an introduction by J. W. Broomhead. Cloth octavo, 1216 pages. London : *The Financial Times*. Price 15s.

This book covers much the same ground as Skinner's ' Mining Manual ' noticed in the preceding paragraph, and is, comparatively, an infant. When a publication thoroughly fills the requirements of its clients, there is no sound reason why other people should issue a book which the majority of customers can only call a duplication.

DIESEL ENGINES FOR LAND AND MARINE WORK. By A. P. Chalkley, with an introductory chapter by Rudolf Diesel. Cloth octavo, 230 pages, illustrated. London : Constable & Co. Price 8s. 6d. For sale by *The Mining Magazine*.

During recent years the gas engine on the Diesel cycle has attracted much attention, as it runs more continuously than the usual gas or oil engine. Hence it is being adopted for marine purposes, where stoppages for cleaning, etc., are out of the question ; and for the same reason it will be acceptable to the mining engineer, who wants an engine that will run night and day with little attention.

CENTRIFUGAL PUMPS ; THEIR DESIGN AND CONSTRUCTION. By L. C. Loewenstein and C. P. Cressey. Cloth octavo, 490 pages, illustrated. New York : D. Van Nostrand Co ; London : Constable & Co. Price 18s. For sale by *The Mining Magazine*.

This book deals rather with the theory than practice of the centrifugal pump, and consists chiefly of translations from German sources.

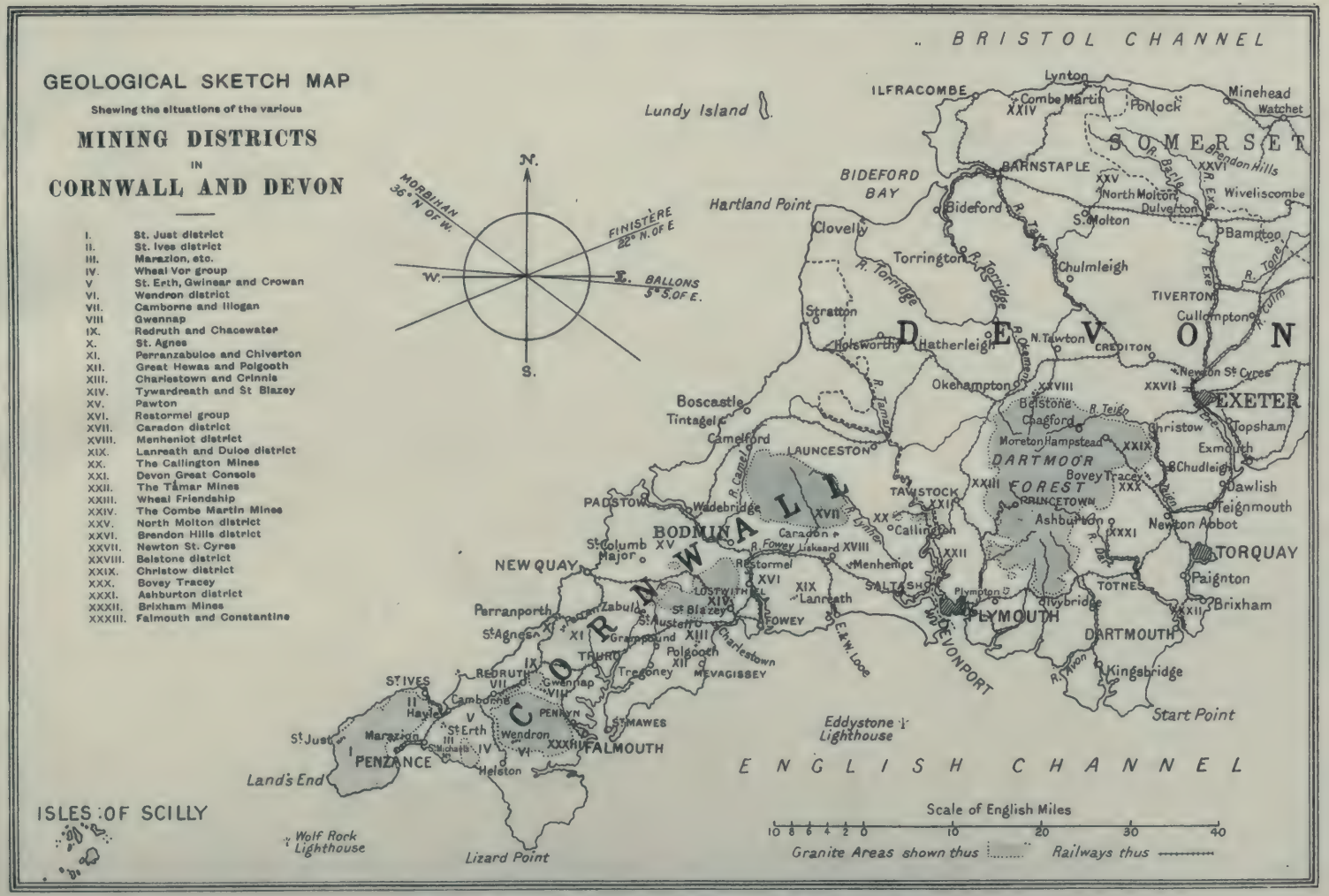
# COMPANY REPORTS

**Mount Morgan.**—The interim report of this gold and copper mine at Rockhampton, Queensland, covers the half-year ended November 30 last. During this period 82,476 tons of auriferous copper ore was smelted, together with 43,131 tons of fluxing ore from the Many Peaks mine; the former yielded 2269 tons copper and 36,136 oz. gold, and the latter 1009 tons copper and 335 oz. gold. In addition, 53,570 tons of silicious sulphide ore was treated by the chlorination process and yielded 26,726 oz. gold and 420 tons copper. The content of Mount Morgan ore smelted during the half-year has shown a considerable decrease as compared with the figures for the year ended May 31, 1911, the yield of copper being 2¾% as compared with 3%, and that of gold 8⅝ dwt. as compared with 10⅛ dwt. On the other hand the ore treated in the chlorination plant averaged nearly 10 dwt. gold as compared with 9⅛ dwt. The explanation of the decrease in the quality of the smelting ore is that stoping is now done in such a way as to prevent falls of rock and other accidents. Important modifications are being made in the smelting operations, for it has been found that by the recent introduction of fluxing sulphide ore from the Many Peaks mine in place of the barren oxide iron ores from Iron Island it is possible to adopt pyritic smelting. A. L. Dean of the Mount Lyell smelter has made an examination and recommends certain necessary alterations. The old practice of producing first a low-grade matte and consequently re-smelting so as to produce a grade suitable for the converter is therefore being abandoned in favour of a single process. During the half-year the revenue from the sale of gold and copper was £452,336, and the expenditure £381,730, leaving a balance of £70,606. A dividend of £50,000 at the rate of 1s. per £1 share was paid in October last, and in order not to make a break in the distribution of dividends £50,000 has been withdrawn from reserve and paid as a further dividend, bringing the total dividend for the half-year to £100,000 or 10% on the £1,000,000 capital. This course has been taken as it is confidently believed that the decrease in yield and profit is only temporary.

**Colombian Mining & Exploration.**—This company was formed in February 1908, to acquire a tract of country in the districts of Supia and Marmato, Colombia, containing a number of gold and silver mines and prospects. Operations have been chiefly directed to the development of the Marmato Hill mine, which had yielded profits to previous local owners. The properties were examined at the time of flotation by C. Olden, L. Parker, and H. H. Knox, and subsequently, when progress was not found to be satisfactory, Arthur Wilkinson was asked to make a report. His recommendations were accepted and he was appointed consulting engineer, with T. L. Dawson as manager. The report now issued covers the operations during the year ended September 30, and shows that development work has been actively prosecuted. Mr. Dawson gives the reserve on September 30 at 81,547 tons averaging 9·6 dwt., and more recent news by cable is to the effect that the reserve had been increased to 109,000 tons averaging 9·8 dwt. The developments at various points are so satisfactory that during the current year it is expected to increase the proved ore by 100,000 tons. The average content is gradually becoming higher. Only sufficient ore has been extracted and treated during the year to pay expenses, the amounts being 15,399 tons milled and 7400 tons cyanided, for a total recovery worth £35,732. The construction of a new plant was delayed until the results of development warranted it. The time has now come for this work to be taken in hand, but before making a final decision, experiments are to be conducted with a view of improving the extraction by cyanide. The new plant will have a capacity of 6000 tons per month at first. During the year 100,000 new shares of £1 have been issued, bringing the total capital to £431,000. With the money thus raised, £37,346 loans have been repayed, and the balance will prove ample for the construction of the plant.

**Arizona Copper.**—In our December issue we gave details of the new policy adopted with a view of reorganizing the smelting plant at this copper mine at Clifton, Arizona. The company has its headquarters in Scotland, and the new plant has been designed by L. D. Ricketts on lines similar to the plant at Cananea, over the border in Mexico. The report now issued by the company covers the year ended September 30 last, and shows that 744,746 short dry tons of ore was raised, yielding 17,292 short tons of copper, or 46·4 lb. per ton. Of the ore raised, 582,335 tons of sulphide and 104,754 tons of oxidized ore was sent to the concentration plant. The smelters treated 153,991 tons of concentrate and raw ore, and the sulphuric acid leaching plant 90,526 tons of oxide tailing. During the year the revenue from the sale of copper was £866,862 and from profits of the railway and other subsidiary interests £72,827. The mining and metallurgical expenses were £625,210, and general charges for administration £29,288; £5266 was paid as debenture interest, £17,881 as income tax, £24,531 as preference dividend, £4,500 was transferred to new capital outlay, and £189,987 distributed as dividend on the ordinary shares, being at the rate of 50%. The directors report that the debenture issue mentioned in our December issue was sufficiently successful to warrant immediate prosecution of the new plans, and orders were at once put in hand for the supply of the plant required. The whole issue was not, however, subscribed, and circulars are now being sent to shareholders with the object of placing the balance.

**Exploration Company.**—The report of this company, of which R. T. Bayliss is chairman, covering the year ended December 31 last, shows a net profit of £34,871, to which must be added £21,377 brought forward from the previous year, making a disposable balance of £56,249. Out of this, £37,500 has been distributed as dividend, being at the rate of 5%, the same as during 1910. Mr. Bayliss, in his speech to shareholders, stated that little change had been made in the company's holdings, and that the El Oro and Tomboy continued to be the principal producers under their control. He reported that the new subsidiary, the Santa Rosa, in Zacatecas, was now equipped with a modern 100-ton plant, and that development work at the Buena Tierra, in Chihuahua, had proceeded so satisfactorily that the time had arrived when it was advisable to float a separate company to continue operations. Particulars of this company are given in the succeeding paragraph. The Exploration company still holds large blocks of shares in American copper companies, acquired before the last collapse of the copper market, and Mr. Bayliss expressed his confidence that within a short time these securities would advance in value owing to the present position as regards production and consumption of the metal. He also reported that the company's real estate in Johannesburg, which has for so long been unmarketable, is at present forming the subject of hopeful negotiations. Another point of interest is that a new company, the China Clay Exploration Syndicate, has been formed




*(From J. H. Collins' 'Observations on the West of England Mining Region').*

for the purpose of acquiring china-clay pits in Cornwall, and of applying the new refining process purchased two years ago. On the board of the syndicate, besides Mr. Bayliss and Mr. Shaw, are James Wickett and J. W. H. Bolitho.

**Buena Tierra.**—As recorded in the preceding paragraph, the Exploration Company has floated a subsidiary, the Buena Tierra Mining Co., for the purpose of acquiring the mine of that name in the Santa Eulalia district, Chihuahua, Mexico. The mine has for some time been a producer, under local ownership, of argentiferous lead carbonate, contained in limestone, and is on the same group of lodes as the Potosi, Santo Domingo, Velardena, and Mina Vieja, mines which have been profitably productive. The ore also contains a large proportion of iron. During the 18 months that the mine has been worked by the Exploration Company, 47,624 tons of ore was shipped to the smelter at Chihuahua, and the price received was $7·71 per ton. The cost per ton of ore delivered at the smelter was $3·89, leaving a working profit of $3·82. The results would have been more favourable, if it had not been for irregularity in the operations of the smelter. The average content of recent shipments was 11 oz. silver and 16% lead. It is expected that the sulphide zone will be reached at 150 or 200 ft. below the 7th or present bottom level. Complete statements of the position are given by R. T. Bayliss, R. M. Raymond, and A. C. Brinker. They estimate the reserve at 250,000 tons, averaging $7·50 per ton, giving a profit of $4·50 per ton, and the monthly output will be about 4000 tons. The yearly profit is therefore figured at £43,000 for 5 years, the life of the present reserve. The capital of the company is £330,000. Of this, £300,000 in cash or shares is the purchase price paid to the Exploration Company, which had devoted £167,927 to the purchase, development, and equipment of the mine. In the present issue, it is intended to devote £30,000 cash as working capital.

**Dolcoath.**—The report of the Dolcoath tin mine, Camborne, Cornwall, for the second half of 1911 contains many interesting items of information, the most important being the substantial decrease in costs. The tonnage crushed was 46,343, and the recovery 853 tons of black tin, or 41¼ lb. per ton. The amount realized was £98,647, or £115. 12s. 6d. per ton. The total receipts were £100,011, the working cost £57,853, lords' royalties £6576, and the working profit £35,581. From the latter, £4340 was written off for depreciation of plant and buildings, and £15,526 was brought in from the previous half-year. The dividend distributed was £34,450, being at the rate of 10% for the half-year. The figures per ton treated were as follow: receipts 43s. 1d., working cost 24s. 11d., lord's dues 2s. 10d., and working profit 15s. 4d. The development work done during the half-year amounted to 2076 ft. R. Arthur Thomas, the manager, mentions that the rich ore reported in the No. 1 winze 306 ft. east of New Sump shaft has not proved to be continuous, for on further sinking the content fell from 80 lb. to only 20 lb. per ton. The electrical plant has now been completed and the new pumping plant has been put into commission. Eight of the new Holman air-cushion stamps have been in continuous operation during the half-year, and the foundations are ready for another four. The most important point, as already mentioned, is the reduction of the working cost by 4s. 5d. per ton. This is due chiefly to the advantages gained by the new Williams shaft. There is every expectation that further substantial reductions will be effected when the electrical and pumping plant is in full working order, and when the additional Holman stamps are completed. As we have recorded in our February issue, operations have been considerably hampered since the turn of the year by water troubles and the output had to be temporarily reduced. During the half-year 4513 of the remaining unissued shares were sold, bringing the total issued capital to £345,008.

**Carn Brea & Tincroft.**—The report for July to December last covers the first half-year during which Edward S. King has been manager. In our issue of July last we outlined the change of policy adopted, when Mr. King, an engineer of wide experience in Australia, was appointed to the post. During the short time he has been in charge, he has effected a number of useful reforms, and in spite of the continued low tin content of the ore mined and the large amount spent on developments and improvements out of revenue, he has been able to show a substantial increase in the profits. The tonnage raised and treated during the half-year was 41,670, or over 3000 tons more than the previous best figure. This increase has been due to the improvements made in the efficiency of the old Cornish stamps. The yield was 439 tons of black tin or 23·64 lb. per ton; this was slightly higher than during the previous half-year, when the yield per ton was 22·29 lb., but is 11 lb. less than three years ago when a discovery of higher grade ore caused a temporary increase in the output. The income from the sale of black tin was £48,483, the highest figure recorded during the life of the present company which dates from 1900. The sale of arsenic and wolfram concentrates, etc., brought the total income to £51,884. The working cost was £44,701, and lords' royalties £1886, leaving a net profit of £5297. The income per ton was 24s. 10d., and the cost including royalties 22s. 4d. The report contains a lucid analysis of the costs; this shows that £3906 was spent on development totalling 1702 ft. Mr. King gave a résumé of his work at the meeting of shareholders, and this is reported in full in our advertising columns. A large amount of shaft-sinking has been done and various sections of the mine have been connected. The reserve of ore has been increased and now stands at three years supply.

**British South Africa Company.**—The report of the 'Chartered' company for the year ended March 31, 1911, is of special importance as it shows for the first time a substantial balance of income over expenditure, amounting to £170,610. As regards the administration of Southern Rhodesia, the expenditure was £648,683 and the income £784,908; of the latter figure, customs duty brought in £273,758 and native tax £207,094. In Northeastern Rhodesia, the expenditure was £46,150 and the income £24,409, of which native tax accounted for £16,741. In Northwestern Rhodesia the expenditure was £102,934 and the income £73,065, of which £40,975 was derived from native tax. In the department of 'commercial enterprise' in South Africa, the expenses were £73,078 and the income £220,907, of which £92,376 was derived from dividends, £71,940 from mine royalties, and £44,633 from land rents. At the London office, the expenses were £51,874 and the income from interest on loans, etc., £60,583. The debenture interest absorbed £70,542, and, as already stated, the balance of income over expenditure was £170,610. An examination of the accounts shows the introduction of a new method of segregating the items into 'administrative' and 'commercial.' It has to be remembered that the charter granted in 1889 was for a period of 25 years. This term expires in 1914 and the question arises as to what will then happen. This segregation of accounts indicates that the company is preparing to hand over the administration of the

country to the Union of South Africa and continue in business as a purely commericial enterprise. The report contains, in addition to the accounts, a review of work done and of progress made, but as we keep our readers informed on these points from month to month we need not recapitulate here.

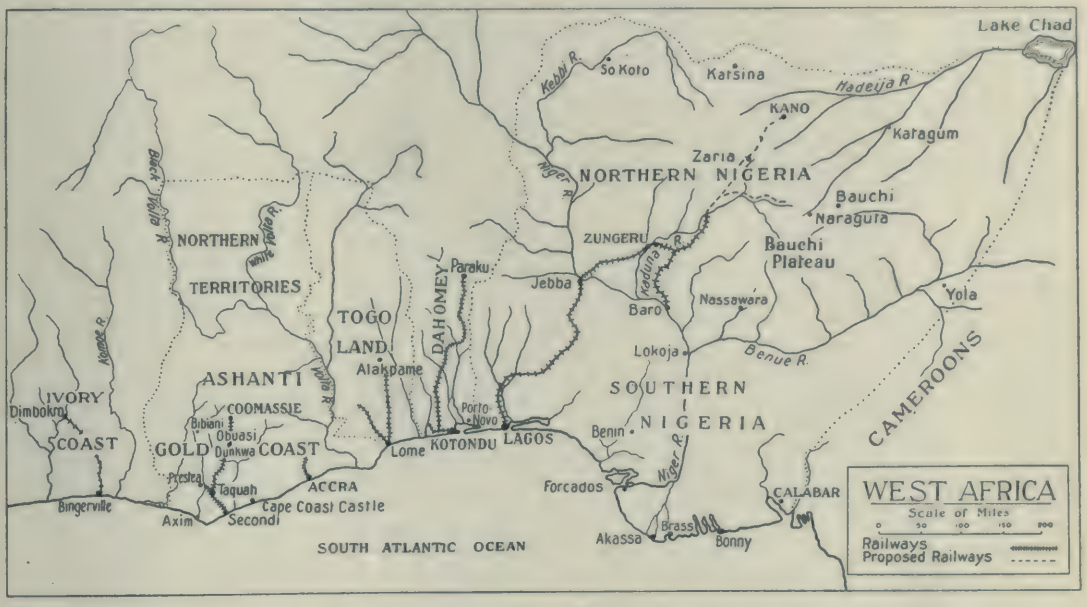
**Wolhuter.**—This company was formed in 1887 to acquire claims in the central part of the Rand. Many rearrangements of the property and of deep levels connected therewith have been made. The control is with the Neumann group. Milling was commenced in 1888, and a new battery was built in 1895–6. This plant was destroyed by fire in 1905, and was replaced in 1906 by a mill containing 120 stamps and 2 tube-mills. A year ago two additional tube-mills were put into service, with the result that the report for the year ended October 31 shows a substantial increase in the tonnage treated and a diminution of the cost per ton. The amount of ore raised was 436,049 tons and, after the removal of 21% waste, 344,015 tons was milled, estimated to average 6·7 dwt. per ton. By amalgamation 73,618 oz. gold was recovered, and by cyaniding 35,617 oz., making a total of 109,235 oz. worth £456,965. The working expenses were £275,024, and the cost of administration £9777, leaving a profit of £172,163. Out of this, £7895 went as tax and £28,128 was spent on capital account. The dividends absorbed £129,000, being at the rate of 15%. The consulting engineer, S. C. Thomson, and the manager, A. R. Robertson, report the ore reserve at 808,780 tons averaging 6·45 dwt. over 51 inches. An interesting point in connection with the development is that a large body of pyritic quartzite has been found between the 15th and 16th levels. During the last few months, labour shortage has been a cause of anxiety. It is impossible to use machine drills in substitution for hand labour in many parts of the mine, as the faulted nature of the ground would lead to falls of the hanging wall. During the year, the figures per ton milled were: yield 26s. 6d., cost 16s. 6d., profit 10s. A year ago the figures were 25s. 6d., 17s. 6d., and 8s. respectively. The company has not heretofore been a large payer of dividends. Distributions were made in 1894, 1897, add 1898, but nothing was paid from the latter date until the year ended October 31, 1910.

**Langlaagte Estate.**—This company, belonging to the Robinson group, has worked an outcrop mine in the central part of the Rand since 1889, and was at one time a leading producer. Ten years ago it was left behind by larger and newer mines. In September 1909, a consolidation was effected with the Block B and Langlaagte Exploration. The report for the year 1911 shows that the assay-value of the ore treated, and consequently the profits, have fallen considerably as compared with the figures for 1910. The 200 stamps and 5 tube-mills crushed 625,187 tons of ore, yielding 175,497 oz. worth £736,853, as compared with 629,614 tons, 202,257 oz., and £847,447. The working cost was £539,021, as compared with £515,571, and the profit £197,832, as compared with £331,873. The figures per ton for 1911 were: yield 23s. 7d, cost 17s. 3d. and profit 6s. 4d. The yield for 1910 was 26s. 11d. per ton. Additional revenue of £21,037 from the sale of stands brought the year's income to £218,869, out of which £130,425 was distributed as dividend, at the rate of 15% (as compared with 30% for 1910), £14,610 was paid as tax, £7678 spent on licenses, etc., and £64,392 allocated to capital expenditure. In addition £19,625 was spent out of capital. Altogether £82,457 was spent on capital account. In the ordinary course of things, this money would have been provided by the sale of unissued shares; but owing to the depressed state of the market, it was found impossible to place these shares at a reasonable price. One of the items of capital expenditure related to the provision of the Butters filter plant. The Langlaagte Estate section is being rapidly exhausted, and the whole of the ore supply will within a short time be coming from the Block B. The ore reserve was estimated on December 31 at 1,281,307 tons, the contents of which are not specified. Judging from the area of the property, the company should be able to continue operations for 25 years.

**Randfontein Central.**—This company, since the middle of March 1911, has owned the great mines of the Robinson group situated in the far west Rand, having a metallurgical equipment including 1000 stamps. Owing chiefly to the shortage of native labour, it has not been possible so far to keep more than an average of 745 stamps at work. The report for 1911 shows that 2,159,033 tons of ore was crushed, yielding by amalgamation and cyanide 632,620 oz. gold. The revenue was £2,661,280 or 24s. 8d. per ton, and the cost £1,807,039 or 16s. 9d. per ton, leaving a working profit of £854,241 or 7s. 11d. per ton. During the year 87,541 ft. of development work was done. The ore reserve was estimated on December 31 at 5,658,859 tons averaging 7·29 dwt. In addition 978,412 tons is reported containing 2·832 dwt., and the profitable and unprofitable are averaged at 6·633 dwt. As regards the financial position of the company, it has been found that the recent capital expenditure on plant and development has exceeded the estimate by £657,000, and as it has been impossible to place the reserve shares to advantage, it has been decided to meet this expenditure out of revenue. Therefore the shareholders get no dividend. The issued capital of the company now stands at £4,000,000; there are £3,000,000 debentures, and a loan from the parent company, the Randfontein Estates, of £365,185.

**Famatina Development.**—We recorded in our December issue that the general meeting was adjourned for three months in order that R. F. Bury, the director who was then visiting the mine, should be able to address the shareholders, and also that the board's recommendations as to future policy should be discussed. The company has now published the new scheme for the rearrangement of capital, whereby the income bonds, profit-sharing bonds, and selling commission are extinguished. The reconstructed company will have a capital of £400,000 in 5s. shares and £200,000 6% debentures. Ordinary shareholders will receive one new share in place of each old £1 share, the total being 563,074; profit-sharing bonds will receive one new share for every three bonds, the total being 170,338; holders of income bonds will receive 257,200 shares; and the International Copper Co. will receive 60,000 shares as part purchase of the selling contract. The debentures will be allotted as follows: £156,000 to be exchanged for the present 10% debentures, and £24,000 allotted to the International Copper Co. as the balance of the purchase price, £20,000 remaining in reserve. The report of Hooper, Speak & Co. on the progress at the mine and smelter, at Chilecito, Argentine Republic, shows that transport difficulties have continued to seriously interfere with mining and metallurgical operations during the year, and that there are severe losses of the metals during smelting owing to their escape as dust. Walter G. Perkins has recently left for the mine in order to improve the smelting operations. The negotiations of Mr. Bury on the spot have resulted in many reforms, and the outlook is now much more favourable.

**Anglo-Continental Mines.** — This company was formed in December 1909 as a reconstruction of the Anglo-Continental Gold Syndicate, and since that time has devoted special attention to the financing of companies operating in Northern Nigeria. Two of the flotations were the Northern Nigeria (Bauchi) Tin Mines, and the Gurum River (Nigeria) Tin Mines. The issued capital consists of £150,000 in 10s. shares, and there are £30,872 debentures. The accounts for the year 1911 show a profit of £29,272. A dividend absorbing £15,000 has been paid. The most interesting news in the report relates to another subsidiary company in the Jemaa district, where a lode-outcrop has been discovered. The information as to the value of the lode is at present incomplete. It is stated that in the prospecting shaft the lode assayed 25% tin. The directors properly caution shareholders with regard to this matter, but they are hardly discreet in their own statements.




**Broomassie.**—This company was originally formed in 1901 to acquire a gold mining property northwest of Taquah, West Africa, together with dredging rights on the Ancobra and Mansi rivers. It has been reconstructed twice, the last time being in October 1909; and about a year ago a rearrangement of the board of directors was made. Bewick, Moreing & Co. were appointed general managers at the time of the reconstruction in 1909. The report now issued covers the financial year ended September 30 last, and includes other information up to the end of 1911. Milling operations were resumed at the beginning of March last year, and from that date to December 31 21,829 tons of ore was treated, yielding 18,727 oz. gold bullion, and 332 tons of concentrate assaying £24 per ton. The cost per ton during this period was 44s. 1d., an abnormally high figure due chiefly to the fact that the mill was not running continuously, owing to underground developments and facilities not being equal to providing sufficient ore. Conditions have since then been improved. The ore reserve in the West Reef was estimated at 34,600 tons averaging 24 dwt. Owing to the irregularity of the orebodies a great deal of development work has to be done. The shoot now being worked is far distant from the main shaft, necessitating a long underground haulage. The main shaft is now down 1196 ft. Large sums have been spent on capital account during the year, on electric generators and pumps, a new headgear and hoisting engine, and improvements in the equipment of the main shaft, in addition to development work. As regards the dredging concessions, some prospecting work has been done but, owing to the capital requirements of the mine, nothing further will be done in this direction at present. The issued capital of the company is £200,498 in 10s. shares, and there are £46,041 of debentures. During the year ended September 30 last, £40,450 was spent in West Africa, £6710 allocated to development redemption, £3941 spent in London, and £2762 paid as debenture interest. The revenue from the sale of bullion was £54,211. The expenditure on capital account was £41,800.

**Goldfield Consolidated.**—The report of this great gold mine in Nevada for the year ended October 31 last shows that 330,549 tons of ore was raised. Of this, 330,062 tons was milled, estimated to contain $32·08 per ton, and 487 tons was shipped to smelters, estimated to contain $355·77 per ton. The yield was worth $10,163,127, or $30·74 per ton, and $1·81 was lost in the tailing. The expenses were $2,636,281, or $7·97 per ton, and the profit $7,526,846, or $22·77 per ton. As compared with the previous year, the tonnage handled was 63,682 tons greater and the cost $3·07 per ton less. The dividend absorbed $7,118,296. The manager, J. F. Thorn, estimates the ore reserve at two years' supply, but these figures are not based on the results of actual forward development, as the ore deposit is not one that lends itself to economical development on a large scale. In future it is expected that the yield per ton will decrease, as some of the high-grade orebodies have been exhausted, but the fall will be compensated by the reduced cost of operations. The prospect for the discovery of new orebodies is good. Additions have been made to the metallurgical plant with the object of treating the whole output on the spot instead of sending some of the ore to the smelters.

**Coal Substitute.**—This company has been brought to the notice of the public at a time considered to be opportune owing to the present coal strike in Great Britain. The capital is £100,000 and 140,000 shares of 10s. each are being offered for subscription and the purchase price paid to the vendors is £65,000 in shares and cash. No mention is made in the prospectus as to the actual nature of the fuel, but it is stated to be produced in the form of briquettes that have been made in brick-making presses and kiln-dried. The raw material comes from Portugal and 30 million tons per annum can be delivered at Lisbon. No coal or peat is contained in the fuel. Sulman & Picard report that it contains 45·8% fixed carbon, 45·65% volatile hydrocarbons and combined moisture, and 7·55% ash. The sulphur content is 0·69%, contained partly in the fixed carbon and partly in the volatile constituents. The calorific power is reported to compare well with coal of average quality. H. Brian Pearson, who is on the board of directors, estimates that the fuel can be sold for 13s. per ton. There is no good reason why the nature of the raw material and the patent process of manufacture should be kept secret.

**Nundydroog.**—In writing a year ago of the performance of this gold mine, belonging to the Kolar group in India, operated by John Taylor & Sons, we mentioned that the year 1910 was a record one as regards yield and profit. The results for 1911 now published show a still further increase in the prosperity. The company was originally formed in 1882, but it was not until 1888 that success was won. Since then the output has steadily advanced, except during the years 1898–9–90, when the workings passed through a lean zone. During 1911, the stamps crushed 102,873 short tons of ore, yielding 81,629 oz. bullion by amalgamation, and 8544 oz. by cyaniding, making a total of 90,173 oz., worth £339,243. The amount of ore crushed was greater by 952 tons and the value of the yield £4494 greater than during 1910. The working cost was £140,002, as compared with £153,812. In addition, £21,870 was paid as royalties, and £8252 as income tax; £10,000 has been added to the reserve fund, £10,251 written off for depreciation of plant, £14,475 spent on additional machinery, £3820 paid as percentage of profit to the directors and managers, and £5000 placed to the 'shares appropriation account.' The dividend absorbed £127,350, being at the rate of 45%, as compared with £117,916 and 41⅔% for 1910. During the year, 12,096 ft. of development work was done, and on December 31 the reserve was estimated at 160,559 tons, an increase of 2308 tons during the year. Additional ground has been acquired during the year to the north and west of the old boundaries. The superintendent, C. H. Richards, gives interesting information as to recent discoveries, all pointing to the continuance of the present satisfactory condition of things. The workings are now down 2450 ft. vertical or 3050 ft. on the lode.

**Mysore Gold.**—This company continues to hold its position as premier mine of the Kolar district of India and the developments still disclose large bodies of ore. The results for 1911 show that the tonnage crushed and the gold extracted both presented record figures. On the other hand, the dividend was less than during the years 1903 to 1907; this fact is explained partly by the lower grade of the ore and partly by the charging of all costs to revenue instead of issuing new shares to meet extraordinary expenditure. The ore crushed during the year totalled 291,477 short tons, and by amalgamation and cyaniding, chiefly the former, gold worth £896,651 was recovered. The working cost was £355,341; royalty £53,201, income tax £26,318, depreciation £13,173, allocation to reserve fund, and £44,344 expended on new plant. The dividend absorbed £366,000, being at the rate of 120%. During the year 31,766 ft. of development work was done, and on December 31, the reserve was calculated at 1,300,369 tons, being an increase of 67,862 tons during the year. The developments in depth are extremely satisfactory at many points. Edgar's shaft has been put in commission, and is an important factor in decreasing the cost. It is intended to commence the sinking of a similar shaft in MacTaggart's section. Additional ground has been acquired to the west of the property on the dip of the lode, so as to protect the deep levels. Since the beginning in 1884, the total yield has been worth £13,472,641. The first dividend was paid in 1886 and the total amount distributed has been £6,651,844.

# TRADE NOTES

*Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.*

**Fraser & Chalmers** have issued for general distribution an eight-page bulletin describing Morison & Bremner's Patent Rapid-Discharge Mortar-Box. The bulletin does not state whether this mortar can be adapted to existing mills and mortar blocks, but we assume that this is the case.

**The Pelton Water Wheel Co.** has absorbed the entire business conducted by the Abner Doble Co. Water wheels and accessories manufactured by these two well established firms are installed in all parts of the world, and this amalgamation will combine unusual manufacturing facilities and engineering ability.

**Macaulay's Blasting Tamping** has just been placed on the market. It is a chemically prepared tamping made up in cartridge form, and its use is intended to neutralize the noxious fumes generated by the explosion of nitro-glycerine underground. It is described in a small booklet which also gives prices and results of tests.

**Ad. Bleichert & Co.'s** two comprehensive catalogues divide their products into 'Automatic Telpherage' and 'Wire Ropeways.' Even engineers, familiar with the handling of products over long distances and the transport of material and finished manufactures in and about plants, will be astonished to find how many useful applications have been made of this overhead system.

**The Worthington Pump Co.** have supplied us with an interesting description of the pumping equipment for the Gladstone Dock now being completed by the Mersey Dock & Harbour Board, Liverpool. The plant includes five 54-in. Worthington centrifugal pumps driven by five Diesel engines of 1000 horsepower. The combined capacity of the pumps will be sufficient to empty the dock (seven million cu. ft.) in 2½ hours. The dock will be large enough to handle the largest steamers afloat or building.

**The International Boring Company** of Erkelenz, Germany, have been making an excellent record with their Raky system of boring in connection with the coal deposits near Dover, where 3321 ft. has been bored in less than eight months. The Raky system has been well known on the Continent for some years, but hitherto has not been in operation in England. The system is described in the standard text-books, but we may briefly remark that rigid rods are used, and that either a short percussive drilling action may be employed or a rotary motion with diamond crown.

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*Scientia non habet inimicum nisi ignorantem.*

T. A. RICKARD, Editor. EDGAR RICKARD, Business Manager.

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# STATISTICS

### Stocks of Copper in England and the Continent.
Reported by Henry R. Merton & Co.

| | Jan. 31 Tons | Feb. 29. Tons | Mar. 30 Tons |
|---|---|---|---|
| In England | 40,182 | 37,056 | 35,732 |
| In France | 5,488 | 5,976 | 6,418 |
| Afloat from Chile | 2,300 | 2,675 | 2,325 |
| Afloat from Australia | 7,600 | 5,800 | 5,700 |
| Total | 55,570 | 51,507 | 50,175 |
| In Rotterdam | 4,900 | 3,600 | 3,300 |
| In Hamburg (estimated) | 8,200 | 7,900 | 7,600 |

### American Copper Producers' Association.
In Tons of 2,240 lb.

| | Production. | Deliveries | | | Stocks at end of month |
|---|---|---|---|---|---|
| | | Domestic | Foreign | Total | |
| July 1911 | 50,075 | 25,438 | 33,429 | 58,867 | 61,491 |
| August | 56,024 | 26,757 | 31,185 | 57,942 | 59,573 |
| September | 51,602 | 25,587 | 22,689 | 48,276 | 62,899 |
| October | 52,792 | 28,602 | 26,832 | 55,425 | 60,267 |
| November | 49,945 | 30,375 | 29,932 | 60,307 | 49,905 |
| December | 54,865 | 29,459 | 35,374 | 64,833 | 39,937 |
| Total, 1911 | 639,258 | 316,791 | 337,009 | 653,800 | — |
| January 1912 | 53,272 | 27,832 | 35,789 | 63,621 | 29,589 |
| February „ | 51,801 | 25,101 | 28,191 | 53,292 | 28,098 |
| March „ | 56,114 | 30,128 | 26,241 | 56,369 | 27,843 |

### Production of Gold in the Transvaal.

| | Rand | Elsewhere | Total | Value |
|---|---|---|---|---|
| | Oz. | Oz. | Oz. | £ |
| July 1911 | 679,881 | 29,377 | 709,258 | 3,012,738 |
| August | 682,405 | 31,002 | 713,407 | 3,030,360 |
| September | 669,773 | 30,852 | 700,625 | 2,976,065 |
| October | 677,923 | 30,721 | 708,644 | 3,010,130 |
| November | 291,466 | 28,267 | 719,729 | 3,057,213 |
| December | 680,782 | 29,126 | 709,908 | 3,015,499 |
| Totals, 1911 | 7,896,802 | 340,921 | 8,237,723 | 34,991,620 |
| January 1912 | 709,280 | 27,780 | 737,360 | 3,130,830 |
| February | 674,960 | 28,906 | 703,866 | 2,989,832 |
| March | *796,755 | 33,968 | *830,723 | *3,528,688 |

* Including 70,143 oz. worth £297,946 extinguished reserve.

### Cost and Profit on the Rand.

| Month. | Tons | Yield per ton | Costs per ton | Profit per ton | Total profit |
|---|---|---|---|---|---|
| | | s. d. | s. d. | s. d. | £ |
| July 1911 | 2,095,220 | 27 2 | 17 10 | 9 4 | 969,687 |
| August | 2,107,809 | 26 8 | 17 9 | 8 11 | 967,457 |
| September | 2,037,329 | 27 4 | 18 1 | 9 4 | 952,665 |
| October | 2,083,900 | 27 0 | 18 0 | 9 1 | 948,278 |
| November | 2,089 387 | 27 6 | 18 3 | 9 3 | 965,729 |
| December | 2,030,439 | 27 11 | 18 4 | 9 7 | 967,897 |
| 1911 | 23,888,260 | 27 7 | 18 0 | 9 7 | 11,414,863 |
| January 1912 | 2,067,161 | 27 6 | 18 10 | 8 11 | 997,557 |
| February | 1,989.396 | 28 3 | 19 2 | 9 2 | 907,192 |

### Natives Employed in the Transvaal Mines.

| | Gold mines | Coal mines | Diamond mines | Total |
|---|---|---|---|---|
| March 31, 1911 | 193,457 | 8,493 | 10,061 | 212,011 |
| April 30 | 194,328 | 8,511 | 10,272 | 213,111 |
| May 31 | 190,392 | 8,379 | 10,425 | 209,196 |
| June 30 | 186,940 | 8,212 | 10,597 | 205,749 |
| July 31 | 181,582 | 8,122 | 11,054 | 200,758 |
| August 31 | 179,810 | 8,182 | 11,292 | 199,284 |
| September 30 | 179,619 | 8,045 | 11,475 | 199,139 |
| October 31 | 179,194 | 8,078 | 11,319 | 198,591 |
| November 30 | 176,736 | 8,043 | 10,071 | 194,850 |
| December 31 | 178,282 | 8,053 | 8,914 | 195,249 |
| January 31, 1912 | 184,046 | 7,805 | 9,524 | 201,375 |
| February 29 | 190,320 | 7,922 | 10,789 | 209,301 |
| March 31 | 196,748 | 8,198 | 12,071 | 217,017 |

### Gold Output of India.

| Year 1910 | Year 1911 | Mar. 1912 | Year 1912 |
|---|---|---|---|
| £2,104,858 | £2,150,050 | £185,855 | £552,894 |

### Production of Gold in Rhodesia.

| Month. | 1908 | 1909 | 1910 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| January | 199,388 | 204,666 | 227,511 | 214,918 |
| February | 191,635 | 192,497 | 203,888 | 209,744 |
| March | 200,615 | 202,157 | 228,385 | — |
| April | 212,935 | 222,700 | 228,213 | — |
| May | 223,867 | 225,032 | 224,888 | — |
| June | 224,920 | 217,600 | 214,709 | — |
| July | 228,151 | 225,234 | 195,233 | — |
| August | 230,792 | 228,296 | 191,423 | — |
| September | 204,262 | 213,249 | 178,950 | — |
| October | 205,466 | 222,653 | 234,928 | — |
| November | 196,668 | 236,307 | 240,573 | — |
| December | 217,316 | 233,397 | 199.500 | — |
| Totals | 2,526,007 | 2,623,788 | 2,568,201 | — |

### Production of Gold in West Africa.

| Month. | 1910 | | 1911 | | 1912 | |
|---|---|---|---|---|---|---|
| | Oz. | Value | Oz. | Value | Oz. | Value |
| | | £ | | £ | | £ |
| January | 17,357 | 70,699 | 15,903 | 66,107 | 26,098 | 107,262 |
| February | 16,976 | 68,469 | 15,179 | 63,081 | 25,009 | 102,270 |
| March | 17,627 | 71,954 | 16,387 | 67,673 | — | — |
| April | 16,363 | 67,069 | 17,237 | 70,880 | — | — |
| May | 16,590 | 68,355 | 24,427 | 96,409 | — | — |
| June | 17,194 | 70,988 | 22,555 | 92,174 | — | — |
| July | 15,564 | 58,551 | 22,510 | 91,955 | — | — |
| August | 13,921 | 57,713 | 25,385 | 103,753 | — | — |
| September | 11,497 | 47,746 | 26,717 | 109,039 | — | — |
| October | 13,341 | 55,046 | 26,826 | 109,503 | — | — |
| November | 14,021 | 57,658 | 24,289 | 99,299 | — | — |
| December | 15,042 | 61,737 | 24,369 | 99,569 | — | — |
| | 185,493 | 755.985 | 261,784 | 1.069 442 | — | — |

### Production of Gold in Western Australia.

| Month. | Export oz. | Mint oz. | Total oz. | Total value |
|---|---|---|---|---|
| | | | | £ |
| Total, 1910 | 363,496 | 1,209,856 | 1,573,352 | 6,682,042 |
| Total. 1911 | 160,021 | 1,210,447 | 1,370,468 | 5,823,522 |
| January 1912 | 10,697 | 95,673 | 106,370 | 451,828 |
| February „ | 10,441 | 92,091 | 102,532 | 435,526 |
| March „ | 408 | 92,597 | 93,005 | 395,058 |

### Other Australasian Gold Production.

| | 1910 | 1911 | March 1912 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Queensland | 1,840,337 | 1,623,390 | *120,260 | 230,970 |
| New South Wales | 803.727 | 769,353 | *59,132 | 113.953 |
| New Zealand | 1,896,322 | 1,808,049 | 125,581 | 401,880 |
| Victoria | 2,422,700 | 2,138,000 | *153,109 | 296,012 |

* February figures only.

### Sale of Tin Concentrate at Redruth Ticketings.

| | Tons | Value | Average |
|---|---|---|---|
| Year 1911 | 6151¼ | £702,599 | £114 4 5 |
| Jan. and Feb. 1912 | 973 | £114,273 | — |
| March 4, 1912 | 268¾ | £31,579 | £117 10 0 |
| March 18, „ | 230¾ | £27,002 | £117 0 4 |
| April 1 „ | 258½ | £30,529 | £118 2 0 |

### Exports of Tin and Ore from Straits and Bolivia.
Reported by A. Strauss & Co.

| | 1911 tons | Mar. 1912 tons | 1912 tons |
|---|---|---|---|
| Metal from Straits to Europe and America | 55,135 | 5,130 | 14,443 |
| Metallic Content from Bolivia to Europe | 22,577 | 1,945 | 4,732 |

# REVIEW OF MINING

INTRODUCTORY.—Since our last issue the base metal mines have again provided the features of the market. Nigerian tin shares after a relapse have become steady again; copper shares have all advanced. It has been announced and stated to be official that the Consolidated Gold Fields has taken 10,000 of the reserve shares of the Anglo-Continental company at £5, a fact that should steady the market in these shares. The price of tin is high again, the latest figure being close upon £200 per ton. Copper is at the present time higher in price, £70 per ton more or less, than it has been for more than four years, and in consequence all copper producers are buoyant. Gold shares have been quiet though with a good undertone. The last returns from the Transvaal are very satisfactory.

TRANSVAAL.—It must be said that several of the mines on the Rand are now giving evidence of better things to come. Prominent among these are the Brakpan and the Modderfontein B. The profit of the former for March was £26,119 and 1000 oz. was added to the reserve, while that of the latter was £30,195. These results are handsome. They were largely rendered possible by a careful segregation of the banket into ore and waste. Thus the Brakpan ore reserve at the end of this year was 1,925,346 tons, to which if the amount of 241,204 tons crushed during the year be added a total of 2,166,550 tons is obtained, which represents the total ore developed from the beginning. During the same time and within the same area 1,224,014 tons of unprofitable banket was disclosed. That is to say that in the area developed about two-thirds of the banket was ore. The development work during the year disclosed good assay-values, which was perhaps to be expected, seeing that a fair proportion of this work consisted in cutting up blocks already proved to be good. A point of interest in connection with this mine, which has been equipped to treat 60,000 tons per month, and which has been sufficiently opened to accumulate a corresponding ore reserve, is that its equipment and development cost £1,185,000. It is anticipated that it will declare a dividend in July next.

The output of gold from the Transvaal for the month of March was declared at 830,723 oz.; this included 70,143 oz. of reserve gold, so that the actual result for the month's work was 760,580 oz. Previous to this 737,060 oz. produced in January last was the best result. The declaration of the above amount of reserve gold initiates a new policy. In future no reserve gold will be carried. The gold will be declared month by month as it is won. The idea of keeping reserve gold in a sort of suspense account was that outputs from month to month might be equalized. However desirable such a regularity might be it would only be justified if it were possible of invariable achievement. That has not been the case; it could not have been the case. The essential distinction of mining is that revenue and profit will fluctuate. The total number of native labourers employed at the end of March in the Transvaal was 217,017 or an increase of 7986 over the figures for February. Of these 196,748 were employed on the gold mines, as compared with 190,320 at the end of February.

The City Deep is very gradually moving ahead to take the place which should belong to it by reason of its ore reserve. In this mine the proportion of unprofitable banket is small. The output of the East Rand Proprietary for March was £280,974, the highest amount the mine has ever reached in any one month. The profit at £101,000 odd was also satisfactory.

It is important that the usual quarterly re-

ports from the mines should be a reliable guide to the shareholders in making their estimates of possible dividends. From the annual report of the Village Deep it would appear that about £38,000 spent during the year upon excess development and chargeable to capital account was not included under that heading in the quarterly statements. The same statements by the Modderfontein B proved to be even more unreliable.

Another record on the Rand: During the month of March 233 feet was sunk in the southeastern shaft of the Government Areas; before this admirable achievement Modder Deep with 213 feet held the record.

The Rand Phthisis Bill (Miner's Compensation) which has been read a first time in the Union Assembly provides that for every rock-driller working in a mine the company shall pay £6 per month, and for every ordinary miner £3 per month, one-fourth of these amounts to be recovered from the miners. Those contributions will be increased or decreased according to deficits or surpluses.

The work undertaken by the Chamber of Mines has now reached such dimensions and importance that further salaried officials have become necessary. To meet this the recently retired president, Mr. H. O'K. Webber, has lately been appointed permanent chairman of the Standing Committees.

RHODESIA.—The final results for last year indicate that the outputs, both of gold and of base metals, made a reasonable advance, the value of the gold being £2,647,895. Among the mines paying dividends, the most important were the Globe & Phœnix with a dividend of £320,000 for the year; the Giant with £103,896; and the Eldorado with £90,000. During the current year the Lonely Reef will probably add considerably to its output, while the Shamva and the Cam & Motor later will maintain the advance. During the last year the Surprise, the East Gwanda, and the Selukwe closed down, while the outputs from the Bucks Reef, the Farvic, and the Battlefields diminished. The latest information from the Shamva is that the first 10 feet of the fourth cross-cut on the third level assayed 18 dwt., which is satisfactory. It would appear that this level is developing well; two cross-cuts more and it will be complete. As long as the rock has fissures, it has gold; where it is compact it carries little gold. No good news has yet been announced from the boring they are conducting at the Giant. The length of the main ore-shoot in the lower levels of the Eldorado is, according to report, not as satisfactory as could be wished. The assay-values on the fifth level of the Cam & Motor are satisfactory. On the 7th level of the Lonely Reef the lode has been exposed for close upon 1000 feet with good assay-values, and where cut on the 8th level it was also good. At the Eileen Alannah a new shoot of ore has been struck on the second level about 950 feet east of the incline shaft; and another shoot also on the Eglantine block over which an option has been secured. Recently a cable was received from the consulting engineer advising that further prospecting on the Jumbo be stopped as there was no hope for the mine in depth. One of the latest properties to be noticed is the Golden Kopje situated not far from the Eldorado. In one block of ground an ore-shoot 1000 ft. long, 17 ft. wide, and assaying 6½ dwt. has been developed; and on another block a shoot 500 ft. long, not so wide, but assaying 14½ dwt. On this property it is projected to erect an equipment sufficient for 10,000 tons per month, for which it is stated there is money in hand.

WEST AFRICA.—The output of the Ashanti Goldfields for the month of March was £40,513, while the profit for February was declared at the same time to be £17,000. Since our last issue the usual dividend of 25 per cent. or 1s. per share has been declared. The Taquah and the Abosso will publish now a statement of revenue and cost each month. We hope the latter will be as inclusive as it

is in the case of the Ashanti Goldfields. The Broomassie continues to improve.

The reports of the meetings of the General Explorers and of the Okoko companies tell us that exploratory work is still proceeding on the Gold Coast. The report of Mr. Daw is decidedly interesting to read and the work appears to have been well conducted. Difficulties of transport have throttled many properties at their birth. We think that these difficulties cannot be disposed of as lightly as Mr. Daw would have it thought. The second report, that of the Okoko, is not interesting ; it is altogether too optimistic. That engineers take no fee but look to take it out of the mine is no guarantee that the mine will ever be profitable. All good engineers are paid for their services ; they find their services in demand. The North Tarkwa Syndicate and Gold Coast Explorers report that on their eastern Andansi concessions they are prospecting with the hope of finding the rich east reef of the Fanti Syndicate. A recent introduction is that of the Temma Tin with a capital of £30,000 to explore a territory in the eastern province of the Gold Coast, about 16 miles from the port of Accra.

The Anglo-Continental Co. has reported that its enlarged area includes a length of nineteen miles along the outcrop while the lode has been traced for eight miles. For a length of 1½ miles the average width is stated to be 30 feet and the average value 20 per cent. Samples of this lode are now in London; from these it would appear that the tin is a regular constituent of the granitic rock. The output from the Jos Tin Area for the month of March was 41 tons, which is very satisfactory. Now with the rains beginning it is probable that the production of tin concentrate from this property in the next few months will diminish again. That from other properties will rise. The Kano Tin Areas report that they have a lode which has been traced for 1½ miles with an average width of 3 feet. The content of tin oxide appears to be irregular, but the manager reports that it will not be difficult to raise several tons of ore per month. It is supposed that by 'ore' he meant 'concentrate.' It is stated that the Ninkada district will shortly be opened for the issue of prospecting licenses to the public. The narrow track railway has now been opened for traffic from Zaria to Rahamma which is within 30 miles of Naraguta.

AUSTRALASIA.—Including capital expenditure on plant, machinery, and development, the Golden Horse-Shoe worked at a loss in February. At the Kalgurli the results being obtained by prospecting on the 200-ft. level continue to be encouraging. The February returns of this and other mines were disturbed by the passage of a cyclone which caused such destruction, as is shown in one of the illustrations elsewhere in this issue. The final dividend of 7s. declared by the Ivanhoe from the results of last year was very welcome. The total working profit for the year was £233,000 from which £220,000 was declared in dividends, which is a high proportion. The development results being obtained on the Waihi continue on the whole disappointing, and depression still prevails, though within the last few days this has at times been lifted. The working profit last year was £371,500 as against £559,000 for the year previous. Of the profit £272,748 was paid in dividends. At the Grand Junction in the main cross-cut south on No. 6 level from No. 1 shaft, the Royal lode was struck, of which the first 6 feet assayed £3. 12s. per ton. The Standard Consolidated Tin mine situated 60 miles northwest of Charters Towers, Queensland, was floated with £50,000 capital, of which £30,000 has been issued ; reports estimate the profit in sight at £63,787. The Great Fitzroy is being formed into a new company of £225,000 from which £22,500 will remain for alterations and additions necessary to bring the company to a proper producing stage. The ore reserve is

stated to be 600,000 tons containing 3% copper and 2·57 dwt. gold per ton. Mount Boppy which started last year with a bright outlook fell short in achievement, this being partly owing to a strike and higher wages and partly to lower grade of ore. Moreover the treatment plant was not suitable for the sulphide ore upon which they had to draw somewhat before the expected time. On the 5th level of Mount Elliott the recent results have been encouraging. A bore-hole exposing there 9 ft. of ore assaying about 10% of copper. This mine has now purchased for £53,125 the Hampden South Consols which lies 20 miles to the northwest. In this mine the profit in sight above the 250-ft. level is stated to more than cover the purchase price, and the ore which for a width of 6 ft. assays 11·7% of copper is stated to be most suitable for mixing with that from Mount Elliott.

At Broken Hill, in the British mine a new borehole, No. 154, on the 7th level has crossed 65 feet of ore. Mr. Klug in making his estimates used stoping widths from 15 to 55 feet. This is one of the properties on the Barrier Range from which much may yet be expected.

CANADA.—The Casey Cobalt Mining Co. is now bagging ore worth £740 per ton. In addition a good strike has been made on the bottom level where for a length of 70 feet a vein 3 inches thick assayed from 5000 to 6000 oz. per ton. Porcupine is now producing gold, a 10-stamp mill having started at the McIntyre mine on March 1.

UNITED STATES.—In the old Camp Bird mine recent development work has given encouragement. No. 2 drift west from winze 527 east was advanced 135 feet in ore with an average of about 37 dwt. for a width of 5 feet. The results from the Oroville Dredging for the past year were unsatisfactory, even the diminished profit having to go toward the equipment of the Pato property in Colombia. For the present the working on the Bear River property which it was once estimated was worth some shillings per share to this company has now been abandoned. It is hoped that the Pato dredge will be working in September next and that the Oroville Dredging may be in the position to begin quarterly dividends again in the first half of next year. The prospects of the Pato property appear good. The San Francisco del Oro has been the cause of trouble again, one evidence of which is that the consulting engineers Messrs. Percy Tarbutt & Co. have resigned.

MEXICO.—The political condition of this country at present is bad; the opponents of Madero are numerous and active. Private correspondence has been far from reassuring. British and American residents are procuring arms and preparing to defend themselves. Many in the larger cities have sent their women and children to the United States. In the Esperanza an important strike was made on the 11th level where the San Carlos vein was struck considerably farther to the north than hitherto, whereby this vein has been established for more than 700 feet on this level. The rises so far have also been encouraging but the winzes less so. This company during 1911 distributed $675,000 in dividends, against $477,910 declared profits. During the current year this disproportion will not be continued; dividends will only be declared half-yearly instead of quarterly as for the eight years now past. With a considerable sum of cash in hand the directors are in a position to consider other properties. The Santa Gertrudis continues to show up well.

SIBERIA.—The Orsk Goldfields reports that at Kolchan a trial run has been made of the 7½-cu. ft. dredge during which the working cost was 6d. per cubic yard. This company has now been legally recognized by the Government and will be able to operate in its own name, the first of the Russian companies to be able to do so. The strike still continues at the Lena.

# EDITORIAL

SIR Arthur Conan Doyle, in his new serial story, takes a wild flight into Jurassic geology. We extend to this brilliant story-teller the same indulgent forgiveness that characterized the attitude of Scotland Yard toward his earlier romances.

WHEN we see in an engineer's report or on a map the words 'dam site,' though the meaning is clear, another expression arises and we cannot repress a smile. That, however, is as far as it goes with us. It has been left to Mr. W. P. Hammon, on page 35 of his report to the Oroville Dredging company, to so far succumb to this confusion of ideas as to set down the expression "dam sight," where the above innocent words were intended. Mr. Hammon evidently did not smile in time.

THE first half-yearly dinner of the Old Freibergers' Society was held at Oddendino's Imperial Restaurant, Regent Street, London, on March 29, and was well attended, a merry and memorable evening being spent. Greetings were received from Mr. Gardner F. Williams, of Washington, Col. Wisser, of San Francisco, and other members unable to be present, while the good wishes of the Anglo-American Club at Freiberg were spoken by Mr. R. A. Baring-Gould. The President, Mr. Edward Hooper, referred to the fact that the Academy would celebrate its 150th anniversary in 1916, and his suggestion that the society should make a suitable presentation to the Alma Mater upon that occasion was cordially received. It may be mentioned that old students of the Freiberg Mining Academy, wherever resident and of whatever nationality, are eligible for membership of the Old Freibergers and that the roll includes already a large number of foreign members resident on the continent and elsewhere outside the British Isles.

IT IS with unusual pleasure that we record the suspension of hostilities between two of the groups interested in rival flotation patents, namely, the Amalgamated Zinc (De Bavay's) and the Minerals Separation, and the adoption of a plan to consolidate the patent rights. We have always advocated such a course, but it is easier to give advice than to carry it into effect, so we are free to congratulate Mr. W. L. Baillieu and Mr. John Ballot on the successful result of their prolonged negotiations. As our readers know, the Minerals Separation contended that the De Bavay process infringed their oil and buoyancy patents, while the De Bavay company, having an option on the Potter patents, were in a strong position as regards the use of hot acid. The agreement relates chiefly to Australia where the processes have been developed. A new company is to be formed there to hold all the Australian patents belonging to the two groups, and to collect royalties from the users. Minerals Separation takes 55% interest and Amalgamated Zinc (De Bavay's) 45%. The latter company will pay royalty to the new company, as will also the present licensees of the Minerals Separation, notably the Sulphide Corporation and the Zinc Corporation. Under this arrangement each group will be free to pursue its own businesses independently. The settlement of this long-standing dispute will be to the advantage of the mining industry in Australia, for many engineers have hesitated to recommend flotation processes for fear of the users being made the butt of legal proceedings. As regards patent rights in other parts of the world, Minerals Separation acquire the rights to the De Bavay and Potter patents,

and, having handed over its Australian interests to the new company, will in future devote its attention to operations outside Australia.

## Technical Reports Introducing Properties.

When a report is published at the time of the introduction of a property to the public or when it forms the ground upon which a prospectus is based, any estimate of profit contained in it should be made on the most careful and conservative lines. Innumerable cases of experience have established the necessity of this precaution, but the mention of one will suffice.

In the year 1899 the Briseis tin mine was brought from Tasmania, not actually but in the manner of speaking, to be floated in England. The vendors had with them reports from Mr. Ferd. Kayser, the general manager of the Mount Bischoff tin mine working in the same island, who estimated that the profit to be derived from the property without exhausting its possibilities was £4,000,000. The data appeared sufficient and the deductions honest. To be absolutely sure, however, Messrs. Lake & Currie were commissioned to make an independent report, which being confirmatory, the flotation proceeded. For the property £150,000 in cash, £200,000 in shares, £160,000 in cash or shares, or a total of £510,000 was paid, leaving £90,000 for the general purposes of the company and for working capital, the total being £600,000. At the time the view was strongly expressed that such an amount for the property was a scandal and a heavy burden upon the mining industry, but we have no doubt that the vendors in the face of the estimates of profit only marvelled at the moderateness of their terms. Certain it is that in comparison with many of the recent Nigerian flotations such an attitude would have been quite justified. But what has been the result of this Briseis venture, so well sponsored by reputable engineers? It has been that the amount of tin concentrate in the drift, instead of being about 30 lb. per cubic yard as originally estimated, has been but a fraction of that amount; that the construction work to bring in the necessary water cost £60,000 where £22,000 was estimated; that in place of dividends between 30% and 40% as originally suggested, an amount has been paid which distributed over the twelve years of the mine's life makes an average of about 5%; and that the capital is at present represented by a reserve of £50,000 and a property from which the shareholders can expect no great return to them. The only bright spots in the story are the efforts to retrieve the position, and the capable management of Mr. Lindesay C. Clark. This experience is unfortunately not unique in mining, yet some of the reports recently published in connection with tin properties in Nigeria would however appear to ignore such a possibility, counting insecure estimates as assured. Thus the concluding extract from the report by Mr. A. E. Thomas upon the Central Lafon Tinfields of Nigeria reads as follows: "From my examination of the property and from the very satisfactory subsequent developments, I think you are justified in floating a company to work this Lafon property with a capital of £70,000, providing for a working capital of £8000, with, say, £7000 in reserve. . . . ." In conformity with this expression of opinion and with its help the public were invited to subscribe to a company having such a capital. Including expenses £55,000 was to be paid for the property, £8000 was to be for working capital, leaving £7000 in reserve. It would be imagined that such a distribution of the spoils in favour of the vendors and against the public would be based upon the most complete and exhaustive valuation. Yet in the report no summary of the prospecting work is given; no measurement of ground proved; no idea of the pounds of tin concentrate per cubic yard; nor is reference made to any plan. Without these

Mr. Thomas is not justified in stating his opinion that in the river beds alone there is more than sufficient tin to pay back the capital, without stating at the same time that this opinion was not based upon the completeness of data usually required.

Again in his report upon the Rukuba properties in Northern Nigeria, the same lack of consideration for the interests of working capital was shown. Where Mr. Thomas estimated £10,000 would be sufficient for this purpose, he advised the flotation of a company with a capital of £100,000, giving thereby the money laid out by the vendors on the original purchase of the property five times the weight which would fall to the same amount entered a month or so afterwards as working capital. Much as the prospects may have ripened in the interval, this differentiation is not relieved from the intention it expresses to secure the interests of the unproductive capital while leaving the productive capital to take its chance. It is insufficient to argue in this case that the issue of the shares for working capital was not made to the public. The shares have been introduced on the public market and extracts from the report have appeared in the public Press, all for the purpose of dealing.

Other cases of misplaced liberality in estimation are afforded by the reports of Mr. L. H. L. Huddart to the Boma Tin Company and to the Berrida Tin Fields, both in Nigeria. In the former Mr. Huddart estimates that there are 255 acres of profitable alluvial ground. His valuation is however based upon 125, of which again it is admitted that 50 were not sufficiently prospected to allow a final estimate. In spite of this he considers that there is no reason to suppose that the remainder of this alluvial ground, that is 130 acres, will not be of similar value. Few engineers will agree with him in this. It is invariably the case that exploratory work is first undertaken where the prospects appear brightest, so that there is good reason to fear that the remaining acreage will not prove anything like so valuable. With regard to working cost also, any estimate made at this early stage is more than likely to be exceeded in actual working though this may not actually be realized till the accounts have been audited. The profit therefore in this case which is insecure on account of inadequate valuations becomes doubly so when there is reason to fear that the cost has been set too low. Yet this venture is put forward with a capital of £105,000, the vendors and associates to receive the following amounts :

| | |
|---|---|
| In cash for property | £27,000 |
| In cash for expenses | 5,000 |
| In cash for underwriting | 2,500 |
| Plus a little more cash | 500 |
| Total Cash | 35,000 |
| In cash or shares for property | 20,000 |
| In shares | 20,000 |
| Total cost of property | £75,000 |

This total will leave £15,000 out of the present issue for working capital and £15,000 will remain in reserve. The promoters, however, are not even satisfied with the above figures, for they have an option over these reserve shares for one year at par. We can only say that Mr. Huddart has helped them in their greed.

Again in his report upon the Berrida Tin Fields, Mr. Huddart states that 120 acres have been proved to have 4 yards depth of gravel; to have 2·5 lb. of tin concentrate per cubic yard; and to have a gross value of £288,000 of which one-half or £144,000 will be profit. In addition there is a total of 230 acres partly proved in which it is reckoned that the average depth of gravel will be 5·5 yards and the tin concentrate 1·6 lb. In estimating the probable profit in this partly proved ground Mr. Huddart says that these 230 acres may be taken to have a proportional value, the depth being greater but the average value somewhat lower, and he gives expression to this opinion by counting half the tin in them as profit. Put more simply his statement is that in the

proved area with a depth of 4 yards the working cost will be 1·25 lb. per cubic yard, whereas in the partly proved area with 5·5 yards, it will be 0·8 lb., this lowering of cost being consequent upon the greater depth. No engineer will allow that this somewhat greater depth can make so large a difference and most will consider that the working cost in the partly proved area cannot be taken as materially less than it would be in the proved area, a correction which would bring down the total profit very considerably, quite apart from the fact that in any case that profit was based on ground not fully proved. Even any reduced figure is on no secure basis. No profit has yet been returned to shareholders from gravel in Northern Nigeria with so low an amount of tin concentrate per cubic yard as that reported in these areas, nor is it likely that in the near future much will be. The property nevertheless will cost the company £125,000.

In all of these cases mentioned we are sorry to see the engineer entirely on the side of the vendor, not holding the balance fairly between that party and the public, as we consider he should. It should be realized that if a venture is considered good its fortune should not be so discounted at the start that it remains good only for the vendors and their associates, and it should be seen that the public, which in the end pays all the fees, should have a partner's honest share. To this end much assistance would be rendered if engineers would give to the public, as give they should, the benefit of the ever-present doubt in mining.

## Alluvial Tin Mining.

In greater part and nearly everywhere alluvial tin mining is conducted in surface or open-cut workings. The most simple of these is where the surface has a good fall and where water is abundant, conditions which, when occurring, are generally found where a deposit is near its source. In such circumstances water is led over the top to be of service in breaking the deposit and to effect its transport down the sluices to the boxes where the separation of the concentrate takes place. Below these the water completes its purpose by carrying the tailing away through a tail-race cut in the ground, to deposit it where desired. Such a method of working is known as 'ground sluicing'; it is the application of sluicing in its most simple form.

Where the deposit is more extensive and it is possible at a reasonable cost to bring in sufficient water under the pressure of a vertical head, then instead of leading the water to fall comparatively quietly over the face it is flung violently there from a jet situated in some central position. The disintegration of the deposit is thereby much more expeditiously effected and great capacity is obtained at a minimum expenditure for labour. This application of water constitutes 'hydraulic sluicing,' or more shortly 'hydraulicking,' which in its simplest form includes also the complete transport of the material by water, first through the sluices and boxes, and then afterwards through the tail-race. It often happens however that the natural fall of the surface will not allow this transport to be so simply effected, and that to get rid of the material it must be elevated, this being done at the lower end of the working. Such a method is often spoken of as 'elevator sluicing.' Finally also it is frequently the case that water under the pressure of a natural head cannot be brought in at a reasonable cost, and the necessary pressure for the jet has to be obtained by pumping. The conditions which necessitate this generally also necessitate elevation of the material and it is usual to find the pumps and machinery for both purposes installed together upon one barge, forming there a complete and independent set which in reality is a suction dredge. Such an arrangement for working constitutes 'dredge sluicing.'

In whatever manner 'sluicing' is conducted the carrying power of running water is used to transport the material. Sluicing is therein dis-

tinguished from actual 'dredging' where the dredge moves over the ground to keep in touch with the advancing face and where in consequence the material undergoes a minimum of transport; there is a simple elevation to the boxes by buckets in front and a discharge of the tailing behind. Dredging however demands for its success an even bottom and freedom from boulders, conditions which only occur far from tin deposits are found. These more generally exist as flat beds occurring regularly under a great depth of overburden much of which is of a clayey character. In working such deposits it is usual to have the overburden either lifted and transported by manual labour or removed by trucks and inclined haulage, leaving the bed of stanniferous gravel to be lifted by itself afterwards. Separation of the concen-

*THE BRUSEH TIN MINE, FEDERATED MALAY STATES.*

the accidented surface usually found where detritus originates.

Both sluicing and dredging find their most simple and general application where the whole thickness of the deposit coming within the range of their appliances is treated without differentiation, that is to say, where there is little overburden to be worked separately, or where the thickness of the overburden is less than that of the deposit. That is however not the situation in which extensive alluvial trate is then conducted in ordinary sluice-boxes situated at such a height and in such a position that the tailing may be run back with water to one of the worked-out areas. This method may be termed 'paddock mining.' When there is little water, separation of the concentrate on a small scale can be made by the use of pans, calabashes, dulangs, etc., in still water to which the material is carried and from which afterwards it is removed by manual labour. This style of working tin alluvium should be ap-

propriately known as 'native mining.'

Lastly where the deposit lies under a still greater depth of overburden, and it then becomes no longer economical to take this all away, shafts are sunk and the material of the deposit alone is raised. This method is known as 'deep-lead mining.'

There are not so many places now where tin concentrate is being obtained on any scale by ground sluicing. It would appear however that it will find some application in Northern Nigeria where it is the method principally employed at the Naraguta. Its chief advantages are that the necessary appliances cost very little and that little time is taken in getting to work. Its disadvantages are that it does not generally allow a cheap working cost, partly on account of the labour necessary to get the material into the sluices and partly also to the comparatively small scale on which it is generally used. Where water is not abundant these costs are increased by the necessity of having labour to assist in dragging the material down the sluices and out of the tail-race. The average cost at the Naraguta mine as given elsewhere in this issue is high and not to be considered normal; for some of the work is done by the more expensive methods of native mining. In the Malay States, though the costs are less than this, they are still high when compared with the larger methods of working. Where however in the same place hydraulicking can be practiced low working costs result and concomitantly the amount of profitable deposit is increased as the boundaries of such deposits are more often determined by economic than geological factors. The cost of the necessary equipment is however very much greater and the whole question of greatest total profit must be nicely estimated before this method is undertaken. Hydraulicking is now being applied to the winning of tin in several places, notably at Gopeng and Bruseh in the Malay States and at Briseis in Tasmania. At Gopeng the material sluiced has an average depth of perhaps 20 feet, below which there is a good granite floor for the sluices. Water power is cheap and water plentiful so that low working costs are possible, the total cost to the shareholders being about 4d. per cubic yard, from which 1 lb. of tin concentrate is usually obtained. At Bruseh where the depth of the working face has reached as much as 200 feet, the total cost per cubic yard is about the same as at Gopeng, though the recovery is considerably less than 1 lb. At Briseis the average depth of the deposit may be taken as 100 feet, some of which requires to be elevated. Over this there is in places a stiff overburden of basalt partly decomposed. Some idea of the total cost may be gathered from the last available annual report, that for 1910. During that year 458,000 cubic yards of deposit was sluiced and 225,000 cubic yards of overburden was removed, making a total of 683,000 cubic yards, for which total the average cost to the shareholder, using the figures from the profit and loss account and including depreciation, was about 1s. 3d. per cubic yard. The overburden was actually more costly to remove than the deposit, but removal is not the only operation; the recovery and marketing of the concentrate entail a cost to the deposit from which the overburden is free, and it may therefore be considered that 1s. 3d. is a fair average figure for hydraulicking at Briseis. The recovery of tin oxide at this mine during the same period amounted to about 2·25 lb. per cubic yard over the total of overburden and deposit together, or about 3·25 lb. over the deposit alone.

Concerning the cost of dredge sluicing the experience at Tingha in New South Wales may be quoted. There with deposits varying from 12 to 25 ft. thick the average working cost per cubic yard varied between 7d. and 9d. and the tin concentrate recovered between 1 lb. and 2 lb. The total cost therefore will probably vary between 9d. and 1s. At Greenbushes and Pilbarra in Western Australia the operating costs of this method are stated to be

about 10d. per ton, from which it may be estimated that the total cost will also be not less than 1s. Two of these suction dredges have within the last year or so been set to work upon the moors in Cornwall with results comparable to those just given though better results were and still are anticipated.

Paddock mining is the method used so largely in the Malay States and it is therefore responsible for a large portion of the world's output of tin. At Tronoh No. 3 mine, where this method of working is employed, the working cost for the year 1910 was about 1s. 7½d. and the total cost about 2s. per cubic yard. In the eastern lead of the same property where the prospecting work showed a thick deposit below a still greater thickness of overburden, it was estimated that the total working cost when divided over overburden and deposit together, that is over a face of about 100 feet, would be about 1s. 6d. per cubic yard, which would probably mean an eventual cost of 2s. If reckoned over the deposit alone these figures would be about 6s. and 8s. respectively; it is interesting to note that this material contains about 40 lb. of tin concentrate per cubic yard.

The winning of tin concentrate by dredging is being typically practiced in Siam by the Tongkah Harbour and Renong Dredging companies. The operating cost per cubic yard to the latter undertaking during the year ending September 30 last was about 5d. per cubic yard and the full cost about 6d., the material dredged yielding about 0·75 lb.

Finally deep-lead mining is proceeding at some places, notably at Tronoh in the Malay States and at Elsmore in New South Wales. At Tronoh Nos. 1 and 2 mines, using this system, the working cost during the year 1910 was about 7s. 6d. per cubic yard, which would mean a cost of 9s. to the shareholders; the value recovered per cubic yard at the same time was about 13s. 7d.

A glance at the various figures of cost given in this review indicates that cost depends very much upon conditions, and that it is not easy to estimate what may be the eventual cost in countries where the conditions are not settled. In Northern Nigeria dredging proper appears out of the question; much of the concentrate will at first be obtained by ground sluicing which is not a method to allow low cost. In one or two places hydraulicking may be practiced, and with such as these low working cost should be experienced. But it would appear that dredge sluicing will have the largest application and in the majority of cases expensive fuel will be required. Under these circumstances it can hardly be expected that the cost will be as low as the experience elsewhere would suggest. At the present therefore no reliable estimate of working cost may be made except a very high figure be taken, and any estimate of profit based on low working cost must be considered on this account alone quite insecure.

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### Costs in Nigeria.

In reply to a letter received from Mr. W. R. Rumbold we are glad of the occasion to give the data upon which we founded the statement on page 176 of our last issue that the Naraguta has yielded about 12 lb. of tin concentrate per cubic yard, and the further statement on page 179 when speaking of the Gurum Extended that we should regard the wash containing only 3 lb. per cubic yard as valueless under the conditions existing at present in Northern Nigeria, or likely to exist there in the immediate future.

In the last yearly report of the Naraguta company it is indicated that the exhaustion of the company's area during 12 months was 10⅓ acres. No figure for the depth is given, but on information from an engineer recently there we set this down at 6 feet, which figure appeared to be confirmed by the photographs in the report. With these figures the number of cubic yards worked in twelve months becomes 100,000 which divided into 540 tons of concentrate, 12 months at 45 tons per month,

gives 12 lb. per cubic yard. Our figure had reference to the wash proper, but if the overburden were shallow so that it could be advantageously passed through the sluices, then a greater depth would be necessary in the calculation, and a smaller recovery per cubic yard would result.

For estimating the cost we will take the depth to be 8 feet, when the recovery becomes 9 lb. The total volume treated in twelve months then becomes 133,000 cubic yards, or say 150,000 for the 13 odd months covered by the period of the report, during which 551 tons of tin concentrate was obtained. From the profit and loss account of that report the following amounts are taken, each of which must be considered as forming part of the total cost:

| | Per ton of tin concentrate | Total |
|---|---|---|
| | £ s. | £ |
| Freight, Transport, Insurance, Royalty | 32. 16. | 18,079 |
| Ore Bags | 1. 0. | 540 |
| Wages on Tin Recovery Account | 11. 11. | 6,354 |
| Mine Salaries, Travelling Expenses, Licenses, Stores, General Expenses in Nigeria | 8. 4. | 4,531 |
| Directors' Fees | 2. 13. | 1,457 |
| Office Rent, Salaries, Cables, General Expenses in London | 2. 16. | 1,544 |
| Consulting Engineer | 0. 10. | 262 |
| Depreciation on Buildings and Plant | 1. 5. | 693 |
| Total Cost | £60. 15s. | £33,460 |

With regard to revenue it is stated that the 551 tons of concentrate was sold for a net amount of £62,603 or at the rate of £113. 12s. per ton. It follows that if 150,000 cubic yards was treated at a cost of £33,460, the cost per cubic yard was 4s. 5½d., or approximately the net proceeds to be expected from the sale of 4½ lb. of concentrate at present prices. These figures are of course those for nearly a year ago and they will be already considerably better now, but on the other hand it must not be forgotten that the Naraguta workings are much more favourably situated for low working costs than the majority of other workings in the same district. We are able to make an estimate of the present cost of tin concentrate in the case of the Jos company, as that company publishes some monthly figures of production and cost. It must be remarked however in regard to these figures that, while the full production is given, only the smaller half of the cost appears, and without some further information this presentation is more than liable to be misleading to many. The figures for the first two months of this year were as follows:

| | Jan. | Feb. |
|---|---|---|
| | Tons | Tons |
| Production of tin concentrate | 29 | 28 |
| | £ | £ |
| Working Expenses | 575 | 400 |
| Development Costs | 125 | 150 |
| Capital Account | 125 | 300 |
| Prospecting additional areas | 125 | 42 |
| Totals | £950 | £892 |

If of these four items only the first two be taken as belonging to the working cost, and to these be added estimated figures for the other items of cost, the result is as follows:

| | £ | £ |
|---|---|---|
| Working Expenses | 575 | 400 |
| Development Cost | 125 | 150 |
| Freight at £25 per ton | 725 | 700 |
| Insurance and Royalty £7. 16s. per ton | 226 | 218 |
| London Expenses £6 per ton | 174 | 168 |
| | £1825 | £1636 |

The total cost of producing 57 tons of tin thus becomes £3461, and if it be considered that the material treated has yielded 8 lb. of concentrate per cubic yard, then the number of cubic yards treated would be 15,960 and the cost per cubic yard 4s. 4d., or if 7 lb. be used in the calculation, the figures become 18,240 cubic yards and 3s. 9½d. In the immediate future the transport cost will be reduced about £7. 10s. per ton, bringing the above figures to 3s. 9½d. and 3s. 3d. respectively, or in terms of tin concentrate 3·75 lb. and 3·25 lb. per cubic yard. In view of these figures and of our information that the Gurum Extended was not situated favourably for cheap working costs, we were of opinion that the wash on this property which contained only 3 lb. per cubic yard was valueless to the shareholder under the conditions existing at present in Northern Nigeria or likely to exist there in the immediate future, and to this opinion we hold.

It would have been thought that this would make little difference to a property where in some places the returns were as high as 35 lb., and the query of Mr. Rumbold therefore makes one fear that the importance of wash with a content of 3 lb. per cubic yard is greater to this company than the remarks of the chairman would have led the shareholders to expect. It must be stated in conclusion that our remark was not applied to the tin deposits in Northern Nigeria generally but to that of the property we were considering. If there were any doubt about that we think our statement on page 177 that at the Naraguta they were now treating profitably material with 3 lb. per cubic yard should have cleared us. It is difficult at all times to get reliable information, but we do our best and congratulate ourselves that we do well. We are, however, always open to correction upon matters of fact, especially from such an one as Mr. Rumbold, whose opinion commands our respect.

## Eileen Alannah.

At the recent meeting of the above company the chairman, Sir John Willoughby, referring to the criticism to which the flotation of this company was subjected said that the terms of this flotation were arranged only after careful consultation with Messrs. A. H. Ackermann and L. Weill. In reading the reports of these engineers again we agree that the chairman was entitled to retire behind them. This move on his part does not however redeem the character of the flotation. When this was carried through, the presence of only one ore-shoot had been established, and this was pitching at such an angle to the west that it would soon be out of the company's ground. Such was the opinion we expressed in our issue for December last, and such it remains most certainly today. The work which has been done since then has shown that on the 5th level this shoot has a diminished extent, while on the 6th level it occurs only to the west of the incline shaft. At this rate it will, one or two levels deeper, be no longer found in the company's ground. That is the position which should be put before shareholders. It is useless to cable as Mr. Ackermann does that the small increase in the ore reserve is due to No. 5 level being in a "contracted area of orebody." He may "look for lateral improvement in depth"; the doubt is whether he will find it. Be that as it may, recent developments have proved what was quite obvious from the plans, that at the time of flotation the reasonable possibilities of this ore-shoot were very limited. That was the burden of our criticism upon the underground position. It was not our only point however. We said that a working cost of 17s. 6d. per ton was considerably too low seeing that the ore was refractory and that the final scheme for its treatment was not yet formulated. A working cost of 19s. 6d. is now indicated and we have little doubt that this will eventually be raised to a figure appreciably above 20s. It is sufficient, however, for our purpose to show that the working cost upon which the terms of this flotation were arranged has since been modified at the expense of the profit in sight, and that the only ore-shoot established at that time has continued its movement out of the property.

If in the meantime a new ore-shoot is being developed farther to the east, as recent results indicate, shareholders must be congratulated. It is a portion of the gamble which succeeded. If also an option has been granted to the company by the original vendors over what may eventually prove to be a valuable extension to the east, shareholders have another cause for satisfaction. This latter, however, did not belong to the original scheme, and if the option is on favourable terms we may claim perhaps that the shareholders are a little indebted for this to our criticism. Until, however, the value of the recent developments is more fully substantiated and the terms of the

above option are disclosed, and until some move is made towards the erection of a reduction plant, we consider the venture but little more secure than it originally appeared to us. The position is this: It is stated there are 188,404 tons of ore developed, containing gold to the value of £550,000. Of this amount 15% may be deducted as not recovered, leaving £467,000 as the total revenue. The ordinary working cost when treating 6000 tons per month will not be less than 22s. 6d. per ton, to which 25% must be added to include depreciation, taxes, &c., making a total of 28s. 1½d. At this figure the total working cost of the above tonnage will be £264,943 leaving £202,507 as the shareholders' profit in sight. But that is not all. Seeing that the erection of the treatment plant has not yet been started, it will be some years before this profit will be fully realized, so that it is not likely that its present value will be much more than one-third of the total issued capital of the company. If the full nominal capital be considered, the position is of course less favourable. There is little doubt that the reserve shares will be issued; it is indeed possible that they will not suffice. The first issue for cash was one of 160,000 shares which realized £180,000. Of this amount £80,000 has been paid to the vendors, leaving £100,000. But it is estimated that the equipment and development of the mine will cost £140,000, which figure, swelled by the costs of the flotation, will cause the reserve shares to be drawn on for, say, £45,000. This, if such issue be at par, would leave £45,000 in reserve with which to purchase the ground over which they now have the option. It is evident from these considerations that the introduction of this further ground may cramp the financial resources, while it is at the same time tantamount to an admission that the original property was not sufficient in itself. Finally, considering the underground position at the time of flotation and the large sum required to reach the producing stage, the high price paid for the property, £250,000 in shares and £80,000 in cash, was not and never will be justified whatever may be the eventual fortune of the venture.

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**Institution of Mining and Metallurgy.**

The annual meeting of this Institution was held on Thursday, March 21, in the rooms of the Geological Society at Burlington House. With the retiring president, Mr. H. Livingstone Sulman, in the chair, and before a large attendance of members, the secretary, Mr. C. McDermid, read the report of the council for the past year, which showed that the progress of the Institution had been more than maintained. Started twenty years ago it has now a membership of 2191, this number having been reached by regular annual increments of which that for last year was one of the highest. Concomitantly the sphere of usefulness has ever widened till this Institution, which set for its objective the advancement of the mining and metallurgical sciences, now also influences the education of students and sets the standards of good practice to the profession. The power to do these things arises primarily from the fact that admission to its membership is now on the basis of strict qualification. Applicants whose qualifications do not satisfy the requirements may sometimes claim with right that they are better in experience or morale than others within the pale, but while this may be true in individual cases there is no doubt that it holds good to an extent which is constantly diminishing, and it is evident that at no distant date admission to this Institution will be such a criterion of standing that it will be essential for all engineers practicing within the British empire to school and train themselves suitably for its membership.

In moving the adoption of the report Mr. Sulman was therefore able to point with pardonable pride to the activities of the Institu-

tion during the year, among which he rated high the part taken by it in the final establishment of an Advisory Board for the Royal School of Mines. Regarding the financial position, the members heard with pleasure from Mr. A. C. Claudet that this was sound, and listened with sympathy whilst he pleaded for a cause which he has so much at heart, the maintenance of a fund for assisting students to take post-graduate courses. For all of these things and for the continued success of the Institution the thanks of the members to the council and officers were most heartily accorded.

In proper order the consideration of the services of the retiring president formed the final act and culminating point of the year's work. Throughout his term of office, as indeed for long years before, Mr. Sulman has shown a devotion to its interests which has commanded the respect of all and a capacity that must have flattered even his greatest admirers. In addition to these professional attributes he has shown a personal sympathy so wide and real as to compel universal response, a response extended to him all the more readily in that during his term of office his one son was claimed to undergo a miner's violent death. On behalf of the members these things were ably voiced by Messrs. Cordner James and Humphrey Morgans, and Mr. Sulman retired covered with the thanks of the Institution. While writing here in human, as separate from professional, vein, it will perhaps be forgiven us if we digress and allude to a little matter concerning ourselves. During the evening a special gold medal was handed to Mr. Walter McDermott for the prominent part he had taken as the Institution's delegate in bringing to completion the erection of the Bessemer Laboratory at the Royal School of Mines. In tendering his thanks Mr. McDermott spoke with such exquisite humour that fearing his remarks will not be officially recorded we endeavour here to set them down. He complained that in our issue of January last, where we voiced our sympathy with the awards of the Institution and recalled the virtues of the recipients, we put him a generation too far back. He was prepared to hear his too admiring friends eventually call him the father of the profession. But grandfather! Never! He was still young and consequently unless this misstatement were corrected it might interfere with his prospects. Admitting he was a grandfather—and this he asked might go no further—it was only a small one, and he did not think that even with the present extended course at the School of Mines it was yet found expedient to take in students at the early age of two. We confess that however good the ground there was for this most natural repudiation, we are glad to have been the match which lighted such a pretty display.

Returning however to the proceedings, the last duty of the retiring president was to welcome Mr. Edward Hooper, his successor, and to invite him to take the chair. This having been done, Mr. Hooper proceeded with the address it is customary to deliver on these occasions. This consisted primarily of a discussion of the factors which in recent years had led to the advance of our profession, and which are now no less necessary for the maintenance of its position among the other professions. First and foremost among these he put that of technical education; the day of pupilage to practicing engineers was past, as no engineer so entering the profession could compete with his contemporaries from the mining universities. Then he emphasized the necessity and benefit of the standardization of units, the clearness of terms and the straightness of language, the observance of which could but give tone and strength either to statements or reports. With the looseness of expression and language allowed in the past many cases of over-esti-

mation of ore reserves not easily forgotten must be associated. Had terms been more explicit they could not have happened except the criminal law had been transgressed. For greater security in this important matter he urged that the ore reserve of any mine, as its most important asset, should be regularly checked and audited. As another factor contributing to the profession's advance, Mr. Hooper put forward the present excellence of technical journals, and we would that Mr. T. A. Rickard had been present to hear this appreciation. Finally but not the last in the order of its importance he referred to the growth of technical societies and especially to that of the Institution of Mining and Metallurgy. We can but congratulate Mr. Hooper on the subject matter of his address and the Institution generally upon its strong and good position.

## Ethics.

Many must lately have speculated as to the proper course for a mine manager to take when the directors insist upon a policy which he considers vitally opposed to the best interests of the mine, or even economically immoral. In discussing this question we define the directors as trustees for the indivisible body of shareholders, and the manager as the person responsible for, and entrusted with, the proper performance of the work. In making his recommendations to the directors, the manager naturally supposes that these will in due course be made known to the shareholders; but if he is satisfied that this will not be done, we consider that, in a case of exceptional gravity, he should, as best he can, bring the matter directly to the notice of the shareholders. It is not sufficient that as a protest he should resign and keep quiet. An ineffective protest of this sort is worthless; it were more logical to bend to the will of the directors, but more honest to publish the position, even though by doing so the rupture with the directors were thereby completed. Yet we more often see that the manager resigns, and though this fact is regrettable, the arguments for such a course are many. First and foremost is the one that for his bread-and-butter's sake a manager is not usually prepared to offend directors, especially in a district where the directors of many mines are closely linked together. It will also be argued that shareholders will not thank him for disclosing the business of the company in such a manner as to make a fall in the shares inevitable, quite overlooking the fact that he may thereby prevent a greater fall. Finally, it will be said that it were time enough to cry out when the mine is actually hurt, before which it might well happen that the position would be retrieved by better developments without any exposure at all. We consider, however, that these arguments should not force the manager from taking a higher conception of the duty pertaining to his position. His honesty and capacity constitute the greatest security that shareholders, both great and small, can have. This he must know. He will further know that he is the one person responsible for the proper working of the mine. With this knowledge he is a poor manager who considers that he is only the servant of the directors, forgetful of the fact that he is the servant of the shareholders, though appointed by the directors. We go further and say that insecurity reigns when the manager places himself not under the directors as a whole, but under one particular and dominating personality, and it should therefore be his care to insist, at the time of his appointment, that this comes from the board as a whole. We do not shirk the logical extension of the contention put forward in the above lines. We regard it as the duty of every employee upon a mine, in exceptional circumstances, to report above the head of his immediate superior. Such exceptional circumstances must however contain, as first provision, the element that the matter has al-

ready been reported in proper form to, and has remained unheeded by, that superior; and as second provision, that, spite and self-seeking being excluded, the good of the concern is the compelling motive.

### Tanganyika Concessions.

In a recent issue of the *Mining and Scientific Press*, we note an interesting letter on the Tanganyika Concessions. The letter is written by Mr. John R. Farrell, one of the early investigators of that remarkable ore deposit in Central Africa. Mr. Farrell takes pardonable pride in having been the pioneer of an industry that promises to assume large dimensions whenever it has passed through the measles of metallurgical misadventure, and the whooping cough of flamboyant finance. No one doubts the existence of plenty of ore, but most well informed people question the efficacy of the technical methods adopted to turn malachite into money. While reading Mr. Farrell's letter, we were favoured with a copy of a report made by Mr. T. W. T. Atherton in 1907. This shows about 11,000,000 tons of 6·3 to 14·4% copper ore actually proved, with as much more in prospect, and more still indicated. Later figures and estimates have not added appreciably to the totals, so we may assume that recent work has been of a confirmatory rather than an exploratory character. Mr. Atherton gives a detailed description of the local geology and infers that the deposit is of a secondary character and originated from the downward migration of solutions enriched by the leaching of a former body of copper-bearing pyrite, now eroded. Pseudomorphs of limonite after pyrite have been found, and in the cores of some of them has been detected a remnant of pyrite, copper stained. The copper content of the existing deposits depends upon the depth to which erosion has proceeded, the upper and richer portion of the secondary formation in the sandstone and dolomite having been partly removed in places. The oxidized and silicious copper mass extends for 200 to 350 feet in vertical depth, according as the topography has sheltered it from denudation. The full depth of the deposit originally must have been as much as 500 feet. The ore is not in veins or fissures, but has impregnated a series of undulating beds of sandstone and dolomite, the latter being leached, leaving a residuum of cellular quartz. Impregnation has varied with the texture and composition of the rocks, but it is obviously limited in depth, so that mining will extend lengthwise and laterally more than vertically. This is important chiefly because it cuts off the hope of finding the sulphide ore that would do so much to simplify the metallurgical problem. As regards tonnage, all observers are in accord as to its bigness. An enormous mass of ore exists and it only needs labour, fuel, machinery, and metallurgical skill. The 'only' however, covers some essentials that at the present moment are still lacking; before they are obtained it is likely that important changes must be made in the plans and administration of the enterprise.

### Efficiency in Concentration.

From the point of view of the scientific mill manager, the degree of efficiency of a concentration process is gauged by the relative percentages of the metal content of the ore that are found in the concentrate and tailing respectively. This, however, is not the ultimate efficiency, for the suitability of the product for further treatment must be also considered. The commercial man on the board of directors is not impressed by the manager's figures for the percentage of recovery, if the smelter subsequently finds the concentrate difficult of beneficiation and the recovery in the furnace incomplete or troublesome. Such a director therefore will refer the matter back to the millman. In a word, the commercial value of the concentrate is as important a

consideration as the efficiency of recovery. A case in point is found in Broken Hill practice, and here it is not only the engineer who prides himself on the results, but the directors also flatter their shareholders with an interpretation of the figures that is far from satisfying the more acutely minded critic. What does it profit the shareholder to know that 90% of the silver, 95% of the lead, and 85% of the zinc are recovered in the lead and zinc concentrates, if the constitution of these concentrates is such that the buyer only pays for 60% of the silver, 75% of the lead, and 65% of the zinc that was contained in the ore. The difference between the two sets of figures must not of course be entirely placed to the debit of the millman, for part of the deductions made by the buyer are legitimately due to metallurgical losses that are unavoidable even with the purest of material; but still a large proportion of the deductions would be obviated if a cleaner separation of the lead and zinc sulphides could be effected. We are aware that we may lay ourselves open to the reproach of churlishness when making this criticism, so we hasten to say that no one has a greater admiration for the really wonderful work effected by the Broken Hill engineers. We do not forget that twenty years ago the treatment of the mixed sulphides was the despair of the expert in concentration, nor that how jigs that would yield a lead product were gradually evolved, nor how that afterwards re-grinding machines and tables were adopted for making a further extraction of the lead, while the victory in connection with the zinc problem is fresh in our minds. Our reason in referring to the matter is not to make light of the excellent work so far accomplished, but to spur the investigator to further researches, so that many thousand tons of metal may be saved to the owners of the mines.

In order to make our argument clear we will analyse the results obtained by the Sulphide Corporation. Our reason for choosing this company as our specific case is that the whole of the lead and zinc concentration is done under one management, instead of the zinc concentration being in the hands of a separate organization; also because owing to the inclusion of the slime in the flotation operations the whole of the sulphides are treated. In this company's last report it is stated that the total metallic recoveries in the two classes of concentrate is 90·2% of the silver, 93·2% of the lead, and 87·8% of the zinc. The lead plant treated 226,768 tons of ore averaging 16·3% lead, 17·3% zinc, and 11·1 oz. silver, and produced 43,446 tons of lead concentrate assaying 61·3% lead, 8·8% zinc, and 28·1 oz. silver; the residue was treated in the zinc plant where 70,606 tons of zinc concentrate was produced averaging 42·7% zinc, 10·9% lead, and 14·7 oz. silver. The basis on which these two classes of concentrate are usually sold is: For lead concentrate, full market price for lead and silver with no deductions in either case, and nothing paid for the zinc content; for zinc concentrate, full market price for zinc with deduction of 8 units, lead at 1s. per unit with deduction of 8 units, and silver at 1s. per ounce with deduction of 5 ounces.

It will be seen therefore that the zinc in the lead concentrate is entirely lost as far as the company is concerned; that a deduction of 8 units of lead and zinc and 5 oz. of silver is made from the content of the zinc, and that the lead and silver are paid for at far below the market price. Thus the company receives nothing for 3823 tons of zinc contained in the lead concentrate, and a calculation, based on these deductions and on the lower prices paid, will show that nothing is paid for 5648 tons of zinc, 6919 tons of lead, and 734,302 oz. of silver in the zinc concentrate. The losses in concentration according to the reported percentages of recovery were 2508 tons of lead, 4774 tons of zinc, and 246,210 oz. of silver. A calculation will also

show that the metallic contents of the ore were 36,890 tons of lead, 39,132 tons of zinc, and 2,512,354 oz. of silver. We may therefore state the results in a table as follows:

| | Lead tons | Zinc tons | Silver ounces |
|---|---|---|---|
| Metal contents of ore | 36,890 | 39,132 | 2,512,354 |
| Loss in concentration | 2,508 | 4,774 | 246,210 |
| Not paid for in lead concentrate | — | 3,823 | — |
| Not paid for in zinc concentrate | 6,919 | 5,648 | 734,202 |
| Total lost to the company | 9,427 | 14,245 | 980,512 |
| 'Paid-for' recovery | 27,463 | 24,887 | 1,531,842 |
| Percentage of recovery in concentration plant | 93·2 | 87·8 | 90·2 |
| Percentage of 'paid-for' recovery | 74·5 | 63·6 | 60·9 |

There is evidently therefore a large margin for further improvement in concentration, though as we have already said, some of the adverse conditions cannot be overcome by any efforts of the millman. For instance, in the distillation of even the best zinc ores or concentrates losses of zinc and silver are bound to occur, and it is for this reason that the buyer is justified in making deductions in connection with these two metals. But otherwise the deductions and reduced prices may be obviated on the part of the producer by the adoption of concentration methods which yield a product more suited to the requirements of the buyer. A greater perfection in concentration methods may reduce the amount of zinc in the lead concentrate and of lead in the zinc concentrate, but the problem is complicated by the inability of the millman to deliver the silver into the lead concentrate. On the other hand we believe that the modern zinc furnace does not lose so much zinc and silver as the buying contracts would lead us to suppose, nor do we think that lead is the undesirable constituent of the zinc concentrate as is alleged by the buyer. The penalties imposed on the mine by the smelter have an awkward way of altering according to the product submitted, and a variation in the composition of a concentrate that would apparently make it more acceptable under the standing contract is often found to induce a corresponding alteration in the mental attitude of the buyer. Therefore, though we agree that the commercial man on the board has reason to ask the millman to improve the concentration from the commercial point of view, the millman may justifiably retort that an equal improvement, as far as the profits are concerned, may be effected by the commercial man himself by insisting on a more equitable basis for the sale of the concentrate.

## Phantom Profits. I.

Recent critical examination of reports and prospectuses has drawn our attention to a fact of fundamental importance to those who buy shares in mining companies and to the professional men who undertake to advise them in these matters. Most engineers when reporting upon a mine give an estimate of the profit to be gained, subtracting the cost of operations from the gross yield in bullion or metal. This operating profit is taken by the promoters and their clients as a basis for calculating the return on the capital invested. In the same way most shareholders on being told, for example, that the profit at a mine is £10,000 per month, jump to the conclusion that £120,000 per annum will be available for dividends. This is a great illusion and comes of the careless use of terms. The operating profit is the difference between the value of the metal extracted and the cost of the mechanical operation by which this is performed, but it does not include all the expenses unavoidably incidental to a mining enterprise; in short, it represents an intermediate stage of book-keeping. The true profit is the final balance remaining for dividends after deducting all expenses at mine or office; these include a number of items of great diversity, some of them apparently extraordinary in the sense that they are not incurred regularly, being replaced by others equally unexpected. As a text for further remarks we give the so-called profits earned by the gold mining companies operating in

the Transvaal during three successive years as compared with the dividends distributed during the same periods.

| | Profit. | Dividends. |
|---|---|---|
| 1908..... | £12,324,029 | £8,751,282 |
| 1909..... | 12,074,302 | 9,504,621 |
| 1910..... | 11,567,099 | 9,119,858 |

The dividends, it will be seen, represented only 76% of the so-called profit. Thus the expense per ton given as 17s. 7d., for example, in 1910 was really 14% more or 20s. 1d., and the profit per ton, given as 10s. 6d. was 24% less or 8s. 0d. The fundamental fact is that any difference between yield and dividend is expense, for the profit is measurable only by the dividend, plus the increase of cash on hand. Of course, to those who are altruists there may be 'profit' in supporting worthy directors or equally worthy workmen, in distributing a percentage to a chairman or to a charwoman; and to those who think in an imperial way it may be a solace to know that the difference between illusory profits and real dividends goes toward the expansion of industry in His Majesty's dominions; but we may assume that to the ordinary business man it is all the same whether the money goes for candles or cablegrams, roads or royalties, dynamite or dinners.

The statistics published by the Transvaal Chamber of Mines are so complete that it is possible to make a generalized statement with accuracy, but in other mining regions it is necessary to examine the reports of individual companies in order to ascertain what proportion of the earnings is distributed in dividends and what proportion is lost is unconsidered trifles of cumulative importance. Thus the Kalgurli Gold Mines, a well managed enterprise, was operated at a 'working cost' stated to be 19s. 11d. in 1911, 20s. 2d. in 1910, 19s. 9d. in 1909, and 20s. 9d. in 1908. The variation is slight, and the average is 19s. 11d. per ton. On examining the returns we find that during the four years, 1908–1911, the total output was 509,838 tons, yielding £1,322,974. Thus the average yield was £2. 12s. per ton. Dividends paid during this period aggregated £616,500. The balance carried forward on July 31, 1911, was £116,326, and the balance brought forward from 1907 was £60,007, therefore the cash increment was £56,319. This, when added to the dividends, makes the total profit £672,819 or 26s. per ton. As the yield was 52s., the actual cost was 26s. per ton or 30% more than the 'working cost.' The 'profit' that disappeared went to depreciation, special expenditure on development and prospecting, administration expenses in London, West Australian tax on profits, income tax in England, travelling expenses, and audit fees. The administration expenses include directors' fees, office rent and salaries of staff, printing, stationery, and advertising, cables, postage, and cablegrams, general expenses and legal charges.

The 'working cost' at the Giant Mines of Rhodesia is given in the annual reports as 17s. 9d. for 1907, 15s. 5d. for 1908, 12s. 5d. for 1909, and 17s. 6d. for 1910. The average is 15s. 9d. per ton. In the four years the output was 250,608 tons, yielding £387,432 or 31s. per ton. During this period the balance on hand decreased by £4324 and the dividends aggregated £125,751, so that the total gain was £121,427, or 9s. 8d. per ton. The yield being 31s., the actual cost was 21s. per ton, or 30% more than the average of the 'working cost' as stated. The difference between the supposed and the real cost is due to depreciation and to expenditure for construction, machinery, debenture interest, and administration expense in London. The last item includes directors' fees, rent and salaries, general and office charges.

The Globe & Phœnix gives 28s. as its 'working cost' in 1907, 26s. in 1908, and 28s. in 1909. In 1910 conditions are stated to have been abnormal; for half of that year the 'working costs' were 37s. per ton, and

in the last quarter they were said to be 35s. per ton. On referring to the accounts we find that during the three years 1908–1910, the output was 191,162 tons, yielding £811,661 in gold. The balance of cash in hand from 1907 was £63,290, and the balance at the end of 1910 was £175,019, the gain being £111,729. If this amount be added to the total dividends paid in 1908, 1909, and 1910, namely, £315,000, it will be seen that the real profit was £426,729, or £2. 4s. 5d. per ton. The yield was £4. 5s. per ton, therefore the real cost was 40s. per ton or 50% more than the normal 'working cost.' In this case the expenses not included in the 'working cost' are depreciation, recruiting for natives, insurances, and administration charges in London. These last include directors' fees and remuneration, salaries, rent of offices, printing, stationery, postage, telegrams, and incidental expenses.

The Alaska Treadwell published a "total operating cost" of $1·54 per ton for the year ending May 31, 1909, $1·57 for 1910, and $1·53 for 1911. The output for the three years was 2,282,938 tons, yielding $5,590,816 or $2·45 per ton. The dividends during the three years amounted to exactly $2,000,000, and the balance carried forward was $132,810 less than it was at the end of 1908. Hence the actual gain was $1,867,190, or 82 cents per ton. As the yield was $2·45, the real cost was $1·63 per ton, or only 5% more than the 'operating cost.' But the accounts show that during the three years a sum of $378,165 was written off for 'depreciation,' and that $75,905 was debited to 'construction.' These make 20 cents per ton or 13% more than the 'operating cost.' This fact, however, is obscured (of course, not intentionally) by the receipt of $251,042 from 'commercial profits,' that is, on sales of merchandise, foundry, butcher-shop, boarding-house, and other trade with the men employed and others in the district. Thus, as compared to other companies, the Alaska Treadwell's 'operating cost' differs from the real cost by 13%. The depreciation is fairly uniform at $125,000 per annum, and the construction fairly regular at $80,000; why cannot these items be included, thereby bringing the operating cost and the actual cost into perfect identity?

The Tomboy Gold Mines Company gives the "total expenses" as $4·67 per ton in the year ending June 30, 1909; $4·80 in 1910; and $4·38 in 1911. The average is $4·62. The balance brought forward at the end of 1908 was £66,331, and that carried forward at the end of 1911 was £63,860; thus there was a decrease of £2471. During the three years a total of £180,000 was paid in dividends; therefore the actual profit was £177,529. In the same period the mine produced 329,626 tons yielding $2,459,258 or $7·46 per ton. As the total profit was £177,529 or $864,566, the profit per ton was $2·62; therefore the actual cost was $4·84, or only 4$\frac{38}{74}$% more than the "total expenses." The portion of profit that disappeared went to directors' fees, agency and consulting engineer's fees, income tax, depreciation of plant and machinery, and the commission to Mr. John Herron. This last was paid to Mr. Herron in appropriate and proper recognition of his special services to the company, from whose employ he had retired.

The five companies whose accounts have been analysed for the purpose of this criticism have been selected mainly because they are representative and because they publish the information requisite for a criticism. Other companies giving figures of cost far more misleading escape attention simply because their statements are so incomplete and untrustworthy that it would be useless to quote them as examples of mining economics. Enough has been said to warrant us in asking professional men, which term includes directors as well as engineers, to give this matter their serious consideration. In our next issue we shall return to the subject.

# METAL MARKETS

## COPPER.

Average prices of cash standard copper:

| Mar. 1912 | Feb. 1912 | Mar. 1911 |
|---|---|---|
| £66. 0s. 4d. | £63. 0s. 5d. | £54. 16s. 4d. |

In spite of the trade dislocation produced by the coal strike, public interest has been drawn to the speculative possibilities in this metal, and the financial Press is devoting attention to the developments which the continued decrease in stocks is likely to produce in the near future. The price of standard copper has accordingly shown sharp advances and has registered a rise of over £5 for the month. At the same time, in spite of the closing of many English works, no diminution in European consumption is visible, while that of America is so much improved that refiners have steadily advanced their prices there to 15⅝ cents (£72) for electrolytic, and are reported to be sold out to the end of June. A fairly formidable bull account must be in existence, and as the long overdue rise has been exceptionally rapid a pause in the movement will make for healthier markets. The low prices which have so long obtained and have done so much to develop the present activity seem at last to be disappearing to the no small disappointment of manufacturers, who, accustomed to low prices, have been lulled into running on low stocks, and are now finding difficulty in getting delivery of the qualities they need. The long promised increase in the American output will be welcomed, when it comes, by the trade, whatever view may be taken by speculators.

## TIN.

Average price of cash standard tin:

| Mar. 1912 | Feb. 1912 | Mar. 1911 |
|---|---|---|
| £192. 15s. 0d. | £195. 4s. 10d. | £182. 12s. 4d. |

The market has been somewhat adversely influenced by the coal strike. Until quite the end of the month, when the high figure of £201. 5s. was realized at the Banka sale, the market's course has been uniformly dull. Speculation seems to have been killed and manipulation destroyed. The range of prices in consequence is within comparatively narrow limits, with a declining tendency for Standard, and an increasing premium for Straits, which the syndicate is still trying to control. If English business is restricted, America has on the other hand been a good buyer in the East, pos sibly in connection with the attempt to transfer the market to New York, and substantial quantities are moving from London warehouses to the same destination. Stocks of Dutch tin have also been heavily depleted. As the statistical position is favourable, and the end of the coal strike should revive the English demand, prospects are in favour of higher prices.

## LEAD.

Average price of soft foreign lead:

| Mar. 1912 | Feb. 1912 | Mar. 1911 |
|---|---|---|
| £15. 19s. 8d. | £15. 13s. 9d. | £13. 2s. 10d. |

This metal has risen steadily and has the appearance of continued strength. In spite of the adverse influence of the coal strike, the demand from consumers shows no falling off. Supplies from Spain have become more difficult to procure, and the Mexican supply is again cut off by the progress of the revolution.

## SPELTER.

Average prices of ordinary brands:

| Mar. 1912 | Feb. 1912 | Mar. 1911 |
|---|---|---|
| £25. 19s. 10d. | £26. 6s. 5d. | £22. 19s. 2d. |

The feature of the month has been the reduction made in prices by the spelter convention, being moved by the long absention of galvanizers from the market. At the last meeting it was decided to make a heavy cut, and enormous quantities were sold as buyers were everywhere short of supplies. Prices then gradually became firmer, and it would seem as if a further rise is inevitable, because the galvanizing trade is exceedingly prosperous in every branch. Zinc sheets are dull.

## OTHER METALS AND MINERALS.

Prices quoted on April 10:

SILVER.—27½d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£59 per ton.

NICKEL.—£170 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£27 10s. per ton.

QUICKSILVER.—£8. 5s. per flask.

MANGANESE ORE.—8½d. to 10½d. per unit (one per cent.)

IRON ORE.—Cumberland hematite 24s. 6d. per ton at mine. Spanish 21s. 6d. delivered in England.

PIG IRON.—Cleveland 52s. 3d. per ton. Hematite 65s. 6d. per ton.

WOLFRAM ORE—30s. per unit (1%).

# SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

## MELBOURNE.

**Mr. Justice Higgins.**—The whole of Australia is at the present time disturbed by labour agitators and by the remarkable decision of the Federal Arbitration Court. Every department of industry is affected by what Mr. Justice Higgins does, and English investors in Australian stocks have to follow the course of that remarkable official. Mr. Justice Higgins was a lawyer-politician with strong socialistic tendencies. He was elevated to the Bench by the party to which he had attached himself. He is a man regarding whose honesty of purpose no doubt is felt, but, at the same time, his politics and his economic beliefs are such as to threaten the well-being of this side of the world. He set out on his political career apparently with the belief that the workers here were under-paid and not properly treated, though every visiting Labourite tells us this is the worker's paradise. That belief he seems to have carried with him to the Bench. No doubt if he was challenged, as he has been on one occasion, in a State Parliament with this partiality, he would be the first to proclaim the assertion as a gross libel. None the less Australia at the present time is ranged into two camps. Labour on the one side regards Mr. Justice Higgins as its saviour. On the other side the capitalist and the man who is engaged in carrying on the industries of the country look upon Mr. Justice Higgins as their opponent. He is viewed by the latter not as a judge but as an advocate.

As indicating the feeling that is entertained towards him an unrecorded incident may now be made public. He was walking across Collins Street, Melbourne, in the front of a tramcar, evidently deep in meditation. He disregarded the alarm bell, rung by the driver, and was only swept out of the way of the tram by a leading politician in the State Parliament, who happened to be sitting on the front of the car. After Mr. Justice Higgins had waved his thanks to those on the tram the politician said to the driver, "That was a narrow escape." "Yes," replied the driver, "he should have got out of the road." "Do you know who it was?" he was asked. "No," came the reply. "Oh, it was Mr. Justice Higgins." "My goodness me," came the retort, "it would never do for us to have killed him." The politician who told this story regarded the whole matter as a joke, but there is a very serious aspect to the dialogue. It shows, as indicated above, that during the continuance

*AFTER THE CYCLONE AT KALGOORLIE, FEBRUARY 5.*

of the great tramway dispute at Brisbane, which nearly involved the whole of Australia in a general strike, the men regarded Mr. Justice Higgins as being on their side. It is long since such a sentiment has existed in a British community. The feeling always has been that any man could approach a Court of Justice without fear. It is no exaggeration of speech to say that at the present moment employers in this part of the world certainly do go to the Federal Arbitration Court with fear, and that they view the decision of Mr. Justice Higgins in the Brisbane tramway case as most dangerous, because of it tending to put the whole industry of this continent under the domination of the Trades Hall.

The question involved in the Brisbane tramway strike was whether men in the employ of the company should defy the management by insisting on wearing a union badge while at work. The management insisted that they should not wear the badge, and certain men were dismissed for disregarding the orders of the general manager in this matter. Then Mr. Justice Higgins summoned a conference, and as the parties could not agree, he had the matter relegated for his decision in the High Court. This very act in itself seems to be wrong. For if one of the parties to a conference summoned by him should refuse to arbitrate, then if Mr. Justice Higgins has concerned himself in trying to promote the arbitration there may be an unconscious bias in the matter. Here, after hearing the evidence, he found in favour of the men, and during the course of his judgment he spoke in a manner which has incited deep resentment. He declared, first of all, that the Federal Parliament had recognized unionism, a proposition which a large section of the community declines to accept, and he then went on to say that where rival unions have been promoted by companies as a set-off against the Trades Hall Union they were only parasitic growths which the companies had planted and fostered. Of course, the whole point underlying the badge question is that this badge is being used by the Trades Hall leaders as a means of coercing the whole of the working community into its camp. Therefore, it is an attack on the liberty of the subject. Mr. Justice Higgins does not view the matter in that light, and he plumps boldly for the Union badge.

Though Mr. Justice Higgins has given a decision that the men may wear their badge, the manager of the Brisbane Tramway company declines to take back any of the unionists who struck. The judge had to admit that he could not force the manager to do this, and apparently he seemed to view his lack of power in that respect as a defect in the law as it stands. There are rumours current at the moment that unionism is determined that the manager shall reinstate the men, and if this should be so then the whole of Australia may yet be thrown into a general strike.

The strength of unionism was illustrated over this Brisbane Tramway strike by the fact that men, working at Mt. Elliott and the Hampden and other mines in North Queensland, threw down their tools out of sympathy with the Brisbane Tramway people. They have since gone back, but there has not been the slightest expression of regret for the loss to which the companies concerned have been subjected.

**Labour at Mount Lyell.**—In Tasmania, the other day, the Mount Lyell employees, because one of their fellow workers unfortunately was killed, declined to go to work. Not a moment's notice was given of their intention. That occurred on the Thursday; they would not work on the Friday because of the funeral and they announced that, as there was a picnic on the Saturday, they would not resume work until the Monday. The directors are sturdy-dispositioned people, and when the two shifts that acted in this manner presented themselves to go down below, they were told that they would have to re-register as employees of the company. This decision has created a great deal of consternation, because only a portion of the men were permitted to resume. The Mt. Lyell shipments of superphosphates have been held up in Adelaide, but there the farmers are sending volunteers to the water-side to handle the manures themselves. They have been told that unless they do this the company cannot guarantee delivery of the superphosphate. Failure in that respect would sacrifice half the crop of the country, and the bucolic intelligence sees that this means a serious loss. Therefore, as the pocket is being touched, the farmer, who for a long time voted the labour ticket, is now arraying himself against unionism. The fate of the Labour Party in politics depends absolutely on the way in which the farming vote goes, so that unless the leaders of the Trades Hall modify the aggressive action of the rank and file of their party there is every probability that a complete revolution in politics will take place here at no far distant date.

**At Broken Hill** the mines are doing well and consequently a scale of wages has been arranged which sets a standard over all the

rest of Australia. There is a steady drift of workers to that centre, but so far they have all been absorbed and the Miners' Unions have therefore not had to feel the effect of the law of supply and demand, except so far that it has operated in their favour. The dividends announced and the profits disclosed by such companies as the Broken Hill Proprietary and the South and North companies within the past month are exceptional. The North company, in addition to paying 5s. per share, has declared a bonus of 15s. per share and the South company pays 6s. per share. The Broken Hill Proprietary has returned to quarterly 1s. dividends and has placed £100,000 to the credit of its reserves within practically six months. So there is every justification why the workers in that part of the world should be placed in the position of sharing in the good times that are going. Trouble may occur when the price of metals recedes, for apart from the continuance of the ore in the South and the North mines to the bottom levels there are no fresh developments of importance in the field with the exception of that at the British.

Theodore J. Hoover, a director of the Zinc Corporation, has finished his investigations at Broken Hill. It is generally understood that he is thoroughly satisfied with the way in which the work is going on there. When the amalgamation between the Zinc Corporation and the South Blocks was carried out, it was criticized in this column. At that time the bottom level in the South Blocks was unpromising, for the grade of ore being broken north and south of the shaft was low. Since then additional work has been done in favour of the mine and the result will be that Mr. Hoover should be able to show a considerable increase in the reserves. It is satisfactory to know that there has been no shortening of the orebody either south or north of the shaft, and what will improve the position further will be if the cross-cut, now being driven 130 ft. below the No. 6 level, should run into good ore, or if the drifts off it should indicate that the lode maintains its value at that greater depth.

*Photo by*] WHEAL COATES, ON ST. AGNES BEACON [*Samuel Solway*

## CAMBORNE.

**Wheal Coates.** — As I reported some months since, this ancient tin mine, situated on St. Agnes Beacon, is to be re-opened, although progress made toward this end is exceedingly slow, which perhaps is only to be expected, seeing the small staff employed. The accompanying photograph, taken by Samuel Solway of St. Agnes, shows the installation, behind the old pumping-engine house on Wheal Coates shaft, of a 60-hp. tandem condensing engine, which will operate a Cornish plunger pump with 14-in. pitwork, all of which is on the spot. The engine will be connected to the main rod in the shaft by means of a flat rod travelling through the old engine house. The temporary pump, that was installed to

ascertain the quantity of water to be handled, has now been taken out and the water is again up to the adit. The building shown in the photograph to the left of the old engine house contains the portable engine and boiler used to operate the temporary pump. A double-cylinder winding engine and boiler are on the property, and the foundations for them are being prepared behind the old stamp engine house, and the intention is to hoist the ore direct from underground to the stamps by way of the only shaft on the property, and an inclined road over the hill. The lode left standing by the old workers, I hear on good authority, will average 18 to 22 lb. of black tin per ton for a width of 20 feet.

**Great Dowgas.**—This property situated at St. Stephens-in-Brannel, that was closed toward the end of last year, after no less than £60,000 having been expended on it, chiefly in the shape of plant, is to be taken over by a new company which has been registered with a capital of £10,000 in 8000 6% preference shares of £1 each and 10,000 ordinary shares of 4s. each. It is gratifying to hear that the mine is to have another chance, it will not be difficult to secure further money to work it on a scale of 100 tons of ore per day, which is the capacity of the battery and dressing plant.

**West Kitty.**—The report of this company from the period from its inception, February 17, 1910, down to December 31 last, can hardly be regarded as a satisfactory document, from the point of view of the adventurers of the old cost-book company who are still waiting to receive their stock. It is now over two years since the new company took possession, and although it is anticipated that the formal transfer of the properties will be completed "within the next few weeks," it is monstrous that it has taken so long to arrange. Seeing that more money is now required, it appears likely that the properties will either be taken over by the St. Agnes Consolidated Mines, Ltd. (which has so far financed the company) or by a new company, so that it may be that the old cost-book shareholders will never receive any West Kitty scrip, but have to take shares in a company with a much larger capital. The prospect of getting anything tangible in the shape of dividends from the new discovery seems remoter than ever.

The accounts show that £49,992 has been charged to development for expenditure incurred on the mine and for administration expenses, from which has been deducted the amount received from tin sales, etc., £19,746, leaving a net amount standing to development of £30,246. The purchase of properties, payable in shares, absorbed £11,382, while £1953 was spent on shafts, machinery, preliminary expenses, etc., or in all a total expenditure in cash or in shares of £43,581. Seeing that the cash received in the shape of capital was only £12,983, and that £11,800 is due to the vendor or cost-book company for purchase consideration, there is a difference of £21,182 owing; of this slightly more than half is for advances from the St. Agnes Consolidated Mines Ltd. The only liquid assets amount to £2294. Thus faced with debts to the tune of close on £19,000, the directors state that a large sum of money is now required to meet this indebtedness and to provide for a proposed increase of milling and power plant, before the company's operations can be brought to a successful issue. It is to be hoped that no difficulty will be found in securing further capital, for the mines warrant vigorous development; but, in my opinion, the present crushing plant is quite equal to deal with the output of payable ore for some time to come. West Kitty by itself is a good proposition on a moderate capital, but if it is merged into some big scheme, as was hinted by the chairman, then I think it will be many a long day before the shareholders see any return on their investment.

**Botallack.**—The reconstruction about a year ago of the company working this famous property did not, after all, provide enough money to complete the unwatering of the old workings and the development of ore sufficient to keep the mill going exclusively on mine-stuff. It will be recalled that the old company was reconstructed with the heavy assessment of 15s. per £1 share, which, naturally, squeezed out a good many of the original subscribers but as more money was urgently needed, and as Pettit & Poore, the consulting engineers, then estimated that £27,000 would be sufficient to complete the work, and the scheme proposed provided £37,500, the reconstruction was accepted with as good a grace as possible. Now it appears that a further £25,000 is required, and this has been raised by means of an issue of 6% debentures, and the simultaneous issue of a further 8100 shares at par. Of the latter, 6750 were underwritten at a commission of 20%, and £22,500 of the debentures at 5%, so that in all close on £27,000 will be available, after payment of the underwriting commissions. All the net profits of each year up to £5000, or 50% of such profits, whichever is the greater, will be paid to a debenture redemption fund.

The new shaft is now, according to the old plans, between 50 to 80 feet below the lowest level of the old workings, and as soon as the 1250-ft. station has been completed, and the pump and auxiliary hoist installed, its sinking will be resumed. Merricks, Crane & Co., the general managers, report that some thousands of tons of ore, averaging about 20 lb. of black tin per ton, is available from the old stopes and pillars, the cost of extracting and treating which at the outside may be taken at 10s. per ton, while the recent developments between the fourth and fifth levels have exposed two to three thousand tons of ore averaging from 35 to 40 lb. black tin per ton, the costs on which are estimated at 16s. 6d. per ton.

The erection of an additional 20 stamps is now in hand, and this should enable the working costs to be reduced: During the twelve months ending February 10 last, the mill dealt with 6966 tons of mine-stuff and 12,595 tons of waste heaps, the return from which was 99 tons of black tin, or an average recovery of slightly over 11 lb. per ton milled. Now that the new shaft is below the horizon of the old workings, and the lodes can be attacked in virgin ground, a large amount of payable ore should shortly be developed. Already £90,000 has been spent on this property. Francis Allen and H. J. Meyerstein have resigned from the board, and General Sir Reginald Pole-Carew is the only original director left.

**Wheal Kitty.** — According to the last monthly report, the grade of the ore is improving, and for the 12 weeks ended March 16 the extraction was 26·7 lb. black tin per ton, as compared with 19·9 lb. during the second half of 1911. The amount of ore raised is rather less, and the reduction is due to better selection underground.

An important step, of far-reaching influence, has been taken by this company, namely, the conclusion of a standing contract for the sale of the output of black tin. Thus, for a year at least, Wheal Kitty will be out of the ticketings, and the probability is that the old method of sale will never be adopted again. This is the first mine to break away from the ticketings, and I have reason for thinking that its policy will be followed by others at no distant date. The tin ticketings, when originally established, proved of benefit at the time to the Cornish mines, but conditions nowadays are different, and their abandonment in favour of sale on the basis of content, less a returning charge, fixed or on the sliding scale, would be to everybody's advantage.

## SAN FRANCISCO.

**Gasoline** is in great demand on the Pacific coast. Next to New Yorkers, Californians own more automobiles than do the citizens of any American state. Climate, scenery, and roads all tempt to motoring and new machines arrive literally by the train load. It is not only the auto that calls for gasoline. Small engines are used for the greatest variety of purposes such as ploughing fields, pumping water, and running machinery of all kinds. When the California oilfields began to attract serious attention the Standard Oil Co. took the lead in establishing refineries. With its magnificent organization and the experience of its staff this company early reached, and has held, a commanding position in this branch of the trade. The Union Oil Co., through its dominance in the coast fields where refining oils occur, came to rival the Standard. The Associated, drawing its supply from the Kern county field which mainly yields heavy oil, was forced to develop the fuel-oil business. The Standard company adopted here, as in Oklahoma, the policy of driving off the lighter oils and selling the residuum for fuel. This gave it a larger profit than the Associated and enabled it to undersell the latter in the fuel-oil market; all of which was the natural result of putting each variety of petroleum to its best use. Despite the fact that the Union and Standard companies have operated their refineries at full capacity, the demand for light oil on the Pacific coast, from Alaska to Lima, has continued to run ahead of the supply and there has been steady importations. Fuel oil and case goods have been sent to the Orient from San Francisco, but Dutch oil has also been brought to California for treatment, and the eastern United States has also been called upon to supply part of the demand. Early in February one tanker brought in 45,000 bbl. of gasoline. Small plants of all sorts have been built in the field to meet the demands of the local market and even little 60-hp. compressors are at work squeezing gasoline out of the natural gas that comes from the field. At one of the larger plants 2000 gal. of gasoline per day is obtained by treating 1,000,000 cu. ft. of gas, and the plant is about to be enlarged to double its present capacity. Now it is reported that the Associated Oil Co. has been quietly engaged in buying wells that produce light oil and in drilling in light-oil territory, and that it is to build a large refinery at Port Costa on San Francisco bay. The plant will be paid for out of surplus, and $1,000,000 has been

set aside for this purpose. It will be remembered that the Associated, while one of the notably successful among California companies, has never paid a dividend, preferring to accumulate a large surplus for re-investment rather than grow by repeated issuing of bonds.

**Dividends** continue to be paid with delightful regularity by the leading oil companies. The total for the month of February was $570,245, and as the list does not change much from month to month, that for February may be quoted as representative.

| Company. | Rate. | Amount. |
|---|---|---|
| Amalgamated | $1·00 | $ 50,000·00 |
| Caribou | ·025 | 8,070·30 |
| Central | ·015 | 15,400·00 |
| Claremont | ·015 | 7,500·00 |
| Columbia | ·01 | 9,992·26 |
| Del Rey | ·005 | 3,927·45 |
| Euclid | ·005 | 1,750·00 |
| *Hale-McLeod | | 14,000·00 |
| Home | ·01 | 7,500·00 |
| Homestake | ·10 | 1,000·00 |
| Mascot | ·01 | 5,000·00 |
| Monte Cristo | ·025 | 12,500·00 |
| *Mount Diablo | ·02 | 10,000·00 |
| New Pennsylvania | ·005 | 2,500·00 |
| Paraffine | ·01 | 3,000·00 |
| Rice Ranch | ·015 | 4,500·00 |
| Record | | 10,000·00 |
| San Fran.-McKittrick | ·10 | 5,000·00 |
| Sauer Dough | 02 | 4,000·00 |
| Section 25 | ·25 | 10,000·00 |
| *State Consolidated | 005 | 5,000·00 |
| Traders | ·006 | 9,000·00 |
| Union | ·006 | 183,387·50 |
| Union Provident | | 90,767·60 |
| United Petroleum | ·006 | 48,450·60 |
| Western Union | ·01 | 10,000·00 |
| W. K. | | 15,000·00 |
| Total California Cos. | | $490,245·71 |
| Mex. Pet., Ltd., pfd. | ·002–3 | 80,000·00 |
| Grand Total | | $570,245·71 |

*Unlisted.

**Water** is giving serious trouble in many portions of the California oilfield and no entirely satisfactory method of meeting the difficulty has been found. It is one of the striking anomalies of the situation that in a semi-arid country where surface water has always been at a premium, underground water now threatens the life of the leading industry. The oil occurs in Mesozoic and Tertiary sandstones dipping from the main ranges. The very structure and porosity that assures the large flow of oil, make a correspondingly large inflow of water inevitable. Owing to the large number of individual holdings and the absence of any adequate system of state regulation and inspection, wells that are drilled with poor judgment or are inadequately protected, are constantly admitting water under heavy pressure into the oil sands. Even with most careful work such an accident must occasionally be expected, and the expense of correcting the mistake may well prove more than the probable profit to the individual well owner. Consequently much good territory is ruined by a few careless, ignorant, or impecunious owners. The companies operating in Kern county have called W. H. Storms, State Mineralogist, into consultation and it is hoped some means may be found for controlling the situation, though legislation will probably be necessary. How serious the matter is may be indicated by the statement that large oil wells have in a few weeks come to produce streams that are 85% water. Use of compressed air so as to pump both oil and water has been adopted by several companies but it is at best merely a palliative. Stringent regulations regarding casing and plugging are demanded. Fortunately the principal interests in the field show every disposition to co-operate in any plan Mr. Storms may recommend.

**Japanese** mining enterprises are making consistent progress. K. Ito and T. Watanabe have recently been in California studying the system of rotary drilling perfected in the oilfields of that state and have employed expert drill-men with a view to more vigorous developing of the Echigo fields. The Nippon Oil Co., Ltd., has been fairly successful in finding light refining oils, and now has a production of nearly 2,000,000 bbl. per annum. Search is to be made for heavy fuel oil. If this be found, it will, curiously enough, enlarge the use of California oil since it will assure a supply on both sides of the Pacific and so convert many hesitating ship-owners. Another recent visitor was Yakeshi Kawamura, assistant manager for the Mitsu Bishi Co., at the Osaruzawa mine. This is the fifth largest copper mine in Japan, and it is situated in the northern part of the main island near the well known Kosaka mine. The ore is concentrated 3 to 1, and smelted in blast-furnaces with pot-roasting of the fine material—the standard practice in Japan. It is interesting to note that the converters have never been introduced here, the native *mabuki* hearths being still used. These allow the making of excellent copper and the initial cost is low. The molten metal is blown nearly 24 hours in a shallow pit lined

with a mixture of charcoal and clay. A new pumping plant is being built on the Yoneshiro river nearly two miles from the mine and when the resulting large supply of water becomes available the mill is to be enlarged. Mr. Kawamura is visiting the copper mines of the United States and will return to Japan by way of London and the continent. At the Ashio mine good progress is being made in building the new refinery and mills. M. Otagawa, managing director for the Furukawa Mining Co., has gone to the mine to take charge temporarily. Plans for the new Tsudo concentrator show that it will include picking tables, rolls, trommels, jigs, Callow cones, Overstrom tables, and Johnston concentrators.

*SILVER KING MILL, PARK CITY, UTAH.*

**Philippine Islands.** With the exception of an Australian dredging company, headed by John McWhae, recently formed to consolidate former interests along the Paracale river, all the principal companies in operation are American. Recently operations in Masbate have overshadowed those in the Benguet district. The chief producer in Masbate is the Colorado which has a 20-stamp mill, erected by Traylor & Co., under the superintendence of C. M. Eye. The first clean-up has given good returns, and this property is likely to become the premier producer. The Old Eastern Mining Co. is preparing to erect a mill on the Syndicate property, where a good orebody has been discovered. The Mt. Cogran company has a 10-stamp mill, erected by the Union Iron Works in 1905, and recently sent in a gold bar from its clean-up. At the Nalasvetan a Huntington mill has been erected by Mr. Boag and the property has turned out some gold bars. In the Benguet district a recent typhoon worked havoc. The Benguet Consolidated Mining Co. operating three or four 3-stamp Hendy mills was put completely out of commission and the Headwaters mill, a 10-stamp cyanide plant erected by Joshua Hendy & Co., of San Francisco, under the superintendence of C. T. Durell, has also shut down because of damage and from financial troubles. F. L. Cole is now in charge of this property. The Major Mining Co.'s 3-stamp Hendy mill with cyanidation annex is still in operation. In a recent storm over 60 inches of rain fell in 72 hours, so it is evident that the natural difficulties of work are not inconsiderable. Mining in the Philippines has suffered from wild-catting and bad engineering, and has been affected as well by the depressed trade conditions of recent years on the China coast. Everyone is now interested to know what the effect of the revolution in China will be upon Far Eastern affairs.

## JOHANNESBURG.

**The Transvaal Chamber of Mines** held its annual meeting on February 29 when H. O'K. Webber, the chairman, reviewed the many important problems with which the gold-mining industry of the Rand has been faced and has had to deal with during the year 1911. The work of the Chamber of Mines is to watch over the interests of the mining industry generally. A few remarks on the points brought forward by Mr. Webber may therefore be of interest. The question of miner's phthisis has at last been thoroughly taken in hand, and it now only remains to be seen how quickly this disease will be stamped out among underground employees. That there will be marked improvements in this direction is certain. Mr. Webber said: "I wish emphatically to point out that the chief reason why there is so much evidence of this complaint today is that the industry is now reaping what was sown by the people of the country three years ago." Three years ago the Chinese left, there was insufficient native labour to fill their place, more machine-drills were used, the danger of inhaling the dust produced by machine-drilling was not fully realized by the white employees, and today very many of these men are suffering from phthisis. The difficult problems of the native labour question still remain more or less unsolved. It must be understood that the existing shortage of native labour has been comparatively sudden, so sudden in fact that there has not yet been time to design and perfect the necessary mechanical appliances and small machine-drills, by means of which it will be eventually possible to greatly economize in native labour. Great improvements have already been made in this direction, and it is only a question of time before the industry adapts itself to the present conditions. In the meantime working costs have increased, and the average value per ton of the ore mined has decreased. The Government at the same time has not done its best to help the mining industry to tide over the difficulty. A short-sighted policy has been pursued, more interest having been paid to the agricultural requirements of South Africa than to those of mining. As Mr. Webber says, a strong policy is now urgently needed, which will make it impossible for the natives to live at ease in their kraals, as they are doing at present, but force them to come out to work in the same way that the white population have to work for their livelihood. To all those interested, not only in the mining industry of South Africa but in the welfare of the country generally, Mr. Webber's remarks are to be commended.

**East Rand Proprietary.** — The 16th annual general meeting of the East Rand Proprietary Mines, held on February 28, will always be remembered by those connected with mining in South Africa. With this meeting there closed, to all intents and purposes, an event unprecedented in the history of mining, a catastrophe which has caused the shares in the company to depreciate in value to the extent of about £6,800,000. The one great mistake is that the same blunder should be made twice. The various groups controlling mines on the Rand and elsewhere will therefore do well to take to heart the lessons which may be learned from the past mistakes made at the East Rand Proprietary Mines. The chairman, Sir George Farrar, stated at the meeting that everything in the past was carried out at the recommendation of the joint general managers, to whom a bonus was promised when the plant was completed and in full running order. The managers stated that, towards the end of 1910, the plant was in good running order, capable of handling 200,000 tons per month, and on the strength of this the board paid the promised bonus. It is possible that this is the root of the past trouble. On being questioned by a shareholder on this point, the chairman said it was in the interest of no manager to do unprofitable work and crush ore below the profitable limit. By this remark, Sir George Farrar shows how little he knows of what actually goes on in many of the mines. Cases in which it is in the interest of managers of the mines on the Rand to do unprofitable work unfortunately occur too frequently, for many reasons, chief among which is that they must obey orders or lose their billets, which they lose eventually in any case whether they obey orders or not. As an example due to over-estimation of profits for market or other reasons, figures as to tonnages and profits for each mine are set. A manager has then, if such figures have been over-estimated, either to admit that the estimates cannot be legitimately arrived at, or to do unprofitable work and obtain the tonnage figures required at any rate. If the former course is taken by a conscientious man, he loses his position, most probably; if the latter course is followed, unprofitable work is done and the manager holds his position until such time as it suits those in control to make a change, when the necessary excuse for dismissing the manager is obvious. Another cause which may give rise to unprofitable work is that which has presumably been the

cause at the East Rand Proprietary, where if a sufficiently substantial bonus had been promised, unprofitable working may have been the result. The chairman, at the meeting, refused to state on what basis the bonus was promised, and what was its amount. These are important points, which should have been made clear. With any bonus system it is imperative that the work, for which a bonus is to be paid, should be passed as satisfactory by a person appointed to superintend the work, and to whom the bonus does not apply, otherwise a bonus system is liable to fail in its object.

**The Mining Exhibition.**—The small exhibition, or rather the collection of various articles and appliances, such as are used in the mining industry, which are now on view at the Transvaal University College, is the outcome of a suggestion made to the Chemical, Metallurgical, and Mining Society, that such an exhibition may have some good effect by inducing the local inventors of appliances, which may be useful in mining, to place their inventions before the public. The idea is a good one for several reasons. Although many of the inventions, on view at such an exhibition, may be of little practical use in themselves, yet they may give ideas to people viewing the exhibit, from which something of practical use may be evolved. It is proposed to make such an exhibition an annual affair. This year the exhibition was arranged in too much of a hurry, with the result that owing to the short notice given many interesting appliances have not been sent in. It is, however, refreshing to see anything, connected with mining locally, start in a small way, and it is to be hoped that as time goes on, this exhibition will grow in size and importance. Even in arranging an exhibition on a comparatively small scale, much work and trouble is entailed, and in this case great credit is chiefly due to F. Rowland, the secretary of the Chemical, Metallurgical, & Mining Society.

**Rand Mine Managers' Association.**—This association has just held its annual meeting at which, in the absence of A. W. Stockett, the president, E. H. Bulman, vice-president, presided. Mr. Bulman, in his remarks as chairman, mentioned the standing difficulty, which is still troubling the mines, of the shortage of native labour, and rightly suggested that some scheme to centralize recruiting as a means of stopping "the ruinous and disastrous competition among the mining companies for labour and to check the gradually increasing rate of native wages." Another point raised by Mr. Bulman was in regard to the "insecurity of tenure of the workman on the mines," about which so much has been said during the past year. That not only the workmen suffer in this direction was clearly shown by figures recently quoted by R. N. Kotze, the Government Mining Engineer, relating to the changes among the mine managers on the Rand. For the years 1909, 1910, and 1911, among about 100 managers the changes amounted respectively to 97, 91, and 80 for the three years. These figures point to an extraordinary state of affairs, which is due to several causes, chief among which are favouritism, leave-taking, the local mining fashion of the moment in respect to nationality and mining training, and last of all real ability. The number of changes taking place amongst the mine managers can hardly mean that there are few capable men connected with mining on the Rand, or that it is impossible to find men who are capable of doing good work in the comparatively easy position of a mine manager. In order that the best results may be obtained from the mines, this question should be thoroughly discussed. At present the existing dissatisfaction and unrest among the men working for the various groups, who, on account of their thorough training, good work, and experience, fully deserve the chance of promotion either by order of seniority or merit, cannot be wondered at, when men, who have worked their way through the various departments of the mines with success, are passed over, when the chance of promotion comes, in favour of those who have not 'gone through the mill.'

**Inexperienced Graduates on the Mines.**—The discussion of the mine accident problem still continues and many excellent articles have been written, including one by M. H. Coombe. There is one point brought forward by Mr. Coombe on which some comment is necessary, and that is in respect to the placing of inexperienced School of Mines students in positions of authority on the mines of the Rand. It is because Mr. Coombe is really in earnest in all that he says and does that the so-called inexperienced School of Mines men's side of the question should be considered. It is unfair of Mr. Coombe to class all technically trained men together and say that they are useless on the mines; it would be just as unfair to class all practical miners together and say that their sphere of usefulness was limited. If that were the case, Mr. Coombe ought not theoretically to hold the position he does today. Mr. Coombe

must admit that, taking for example two men of equal ability, both having had the same amount of practical experience, one however being fortunate in having had a good technical training, of the two he would choose the one with some technical knowledge for work under him. The very fact that a man had had a good technical training would mean that in working under a good practical man, such as Mr. Coombe, the trained man would learn the practical side of mining in at least half the time that the untrained man would take to absorb the same amount of knowledge. The technically trained man is therefore able to do good work in the actual practice of mining underground, after having spent only half the time at actual practical work that would be required by the untrained man. There are many miners on the Rand at present who have had even more practical experience than Mr. Coombe, but they have not profited by their experience as he has. On the other hand there are many School of Mines men, who unfortunately have not yet had as much experience as Mr. Coombe, but who have thoroughly profited by what experience they have had, and who, with the added incentive of being anxious to improve their position, are naturally keen on doing their best at their work, so that after what may be taken to be a comparatively short time on practical work, looked at from a practical man's standpoint, they are capable of doing good work as shift-bosses or mine captains. There are admittedly many technically trained men, who through want of tact and keenness, tend to give all the men of their class a bad name among the miners they work with, but these are in the minority, and in the end give up mining altogether. There is an important point, which must not be overlooked, in favour of the technically trained men, and that is, that the ordinary miner will instinctively obey them, so long as they are gentlemen, more readily than he will obey a man of his own class put in authority over him. No one can have had experience in every detail of the work on the mines, but for those in authority the important point for them to consider is the treatment of those beneath them, in such a way that all may work together in a satisfactory manner, when each individual will be anxious to put his best effort into the work. The tendency is then for each man to become a specialist in his own line, about which he should know more than his chief, whose work it should be rather to point out where the work is required than to go into the minor details of such work.

## TORONTO.

**Canadian Mining Institute.**—The fourteenth annual meeting of the Canadian Mining Institute was held on March 6, 7 and 8, at the King Edward Hotel, and was a highly successful and representative gathering. The attendance was large and included a number of visitors from the United States and England. The programme was extensive and varied, and many of the papers aroused keen discussion. After a brief address of welcome by W. H. Hearst, Ontario Minister of Lands, Forests, and Mines, emphasizing the advance made in the mining industries of the province, and the great opportunities presented by the opening up of the undeveloped territory, Frank D. Adams, of the McGill University, the retiring president, delivered his annual address. He congratulated the Institute on the growth of its membership, which showed an increase from 850 to 945, and reviewed its work; he dwelt on the relations of the geologist to practical mining, pointing out the immense economic value accruing from geological research, and the growing appreciation by those in charge of large industrial undertakings of the services of geologists. Statements of the mineral production of the Dominion and of the provinces of Ontario, Quebec, and British Columbia for the year 1911 were presented. The preliminary report from John McLeish, of the Canadian Department of Mines, on the mineral production of Canada gave the value of the total metallic output as $46,197,428, and the non-metallic as $56,094,258, a total of $102,291,686, as compared with $106,823,623 for 1910, or a decrease of 4%. This was explained as being due to the coal miners' strike in Alberta and British Columbia, which not only reduced the coal output from 12,909,152 tons to 11,291,553 tons, but occasioned the closing of the Granby smelter, thus diminishing the output of silver, copper, and gold. The only item in the metallic list showing an increase was pig iron, which was produced to amount of 917,535 tons of the value of the $12,306,860, as compared with 800,797 tons, valued at $11,245,622 in 1910. The production of cement showed an increase from 4,753,975 barrels of the value of $6,412,215 to 5,635,950 barrels, value $7,571,299. The output of steel ingots and castings was 876,215 tons as against 822,284 tons.

The report of the mineral production of Ontario for last year, presented by Thomas W. Gibson, Deputy Minister of Mines, gave the total value as $41,432,898, as compared

with $39,313,895 for 1910. The leading item was silver, 31,507,791 oz. of the value of $15,949,019, exceeding the output of 1910 by approximately one million ounces. The entire production came from Cobalt and the surrounding region. Gold was produced to the amount of 2153 oz. of the value of $42,638.

The question of the proposed legislation for workmen's compensation was discussed and referred to a committee, who presented the following resolutions, which were unanimously adopted :

(1) That the Workmen's Compensation Act be placed in the hands of a commisson to be appointed by the Crown ;

tended by about two hundred, the invited guests including W. H. Hearst, J. Parke Channing, John Birkinbine, T. A. Rickard, W. R. Ingalls, F. H. Sexton and E. B. Wilson.

**Porcupine.**—The results of the operation of the 10-stamp mill of the McIntyre, which began operations early in March, are regarded by the management as highly satisfactory. The actual recovery is over 75% on the plates, and the concentrate is being bagged for cyaniding. Three of the five shafts are supplying ore from the 200-ft. level. The management has decided on the erection of a larger mill of from 300 to 500 tons daily capacity, plans for which are now being prepared. The new

*PEARL LAKE DIRECTORS VISITING THE MINE.*

(2) This commission shall collect a definite amount from each mining company, based upon the monthly pay-roll and proportionate to the risk incident to the business ;

(3) These amounts should be contributed by the employers, and should not be collected directly or indirectly from the employees;

(4) The distribution of this fund shall be in the exclusive control of the commission, from whose decision there should be no appeal to ordinary courts ;

(5) There shall be no liability except under the Act, all common-law liability to be exexpressly excluded.

The election of the president excited much interest, and resulted in the choice of Dr. Alfred E. Barlow, of Montreal. The meeting closed with the annual dinner which was at-

manager, F. P. Swindler, formerly of Nevada, is now in charge. At present 12 drills are at work on 12 faces on the property. Three of the shafts are being put down from the 200-ft. level. On the arrival of A. G. Merrill, of the Merrill Metallurgical Co. of San Francisco, the designer of the Dome 40-stamp mill, at Porcupine, a trial run will be made for which everything is in readiness. There is definitely blocked out at the 50-ft. level an orebody 300 ft. long by 200 ft. wide. An adit has been driven from this level to the surface at an angle of 12 degrees, up which ore cars will ascend to the head of the mill. Six diamond-drills are operating in the swamp between the Dome and the Dome Extension properties to search for the contact of two zones discovered on the Dome Exten-

sion, where at depths varying from 200 to 600 ft. drilling has encountered quartz leads varying from 1 to 19 ft. in width. Three series of veins were discovered which show indications of forming a contact in the swamp between the Extension west line and the Dome's 'golden stairway.' The Vipond has cut its No. 3 vein at the 200-ft. level. At about 80 ft. from the cross-cut the vein extends across the face of the drift and is apparently equally good as on the 100-ft. level, where it runs $11 to the ton. It has been developed at the 100-ft. level for 600 ft. and a rise is being made to the surface. Slow delivery of machinery has delayed the construction of the mill. Recent developments at the Hollinger are regarded as confirmatory of the annual report, vein No. 4 showing considerably higher metallic content than indicated, and No. 2 yielding well in tonnage and quality. Two rises are being put through from the 100-ft. level of No. 1 vein to the surface to block out ore from the mill, and a winze is being sunk from the 200 to the 400-ft. level. The Crown Chartered has paid an instalment of $28,750 on the Davidson property due March 9, and is pushing development. The Pearl Lake has nearly completed its shaft-house, which is 30 ft. square at the base and 60 ft. high, the largest structure of its kind in the camp. The Gold Crest has ordered a plant and will at once begin sinking to the 100-ft. level. The shareholders of the United Porcupine have authorized the directors to borrow $25,000 to continue development work. Active work has been started on the three Roche claims north of Three Nations lake, where several rich leads were found in the conglomerate last autumn. The last section of the Porcupine branch of the Temiskaming & Northern Ontario railway has been completed and trains are now running regularly to Timmins.

**Cobalt.**—The Nova Scotia mill has been closed. After about six months trial it was discovered that the pan-amalgamation of low-grade ores and the cyanidation of the tailing was not practicable at competitive rates and with a high extraction guaranteed. For ores in the diabase good results were obtained, but with Keewatin and conglomerate low-grade veins it was found impossible to obtain the high extraction required by the contracts made with the mines. The directors will shortly decide whether the mill shall be altered so as to admit of concentration, or the contracts abandoned. A forecast of the annual report of the Nipissing gives the ore reserves as on December 31 at approximately 7,800,000 oz., representing an increase of 1,300,000 oz. The ore on the dumps will contribute about 1,000,000 oz., the gross value of the high-grade showing a slight increase. It is expected that the figures of production and costs will be approximately equal to those of the previous year. The financial statement shows cash on hand, value of ore in transit, &c., as $1,468,000. The usual dividend has been declared. Ellis P. Earle, president of the Nipissing, has resigned from the directorate of La Rose, assigning as a reason dissatisfaction with the policy of piling up a large cash reserve instead of increasing dividends. La Rose is now working at the lowest depth of any company in that part of Cobalt. The winze put down from the third level has reached a depth of 210 ft., being 450 below the surface. It will be continued until Keewatin is reached. With the declaration of a 10% dividend, the McKinley-Darragh has amortized its capitalization, the total returns to shareholders being 106%. At the annual meeting of the Temiskaming last month, a number of shareholders who objected to the purchase by the company of the North Dome mine, Porcupine, attempted to oust the old directors, but were unsuccessful. A 3% dividend has been declared, and the shareholders have been asked to express their opinions on the North Dome mine by ballot. The Right of Way has taken an option on properties in the Silver mountain district near Port Arthur. The financial statement of the Cobalt Lake shows that the position of the company has considerably improved. It has a balance to its credit of $80,847, as against a deficit of $209,004 at the end of 1910. Net returns from ore production were $323,793, out of which $64,216 was expended on the construction of a concentrator. The ore reserves are estimated to contain 2,851,180 oz. At the Silver Leaf, which has for some time been under a cloud, an inch vein carrying silver and galena has been struck at the 470 ft. level in the Keewatin. The annual report of the Hargrave for 1911 shows a total production of 113,000 oz. of a gross value of a little over $58,000, and expenditure of $59,148. In addition, $10,478 was spent in acquiring a Porcupine property. The amount of cash in hand was $22,954. The Casey Cobalt, owned in England, has increased its capital from £200,000 to £250,000 in order to replace its plant and install a concentrator. The Beaver has declared an interim dividend of 3% after installing and paying for a mill.

# PERSONAL

A. ADIASSEWICH is in the Caucasus.

A. W. ALLEN left London on April 6 to take up a position in Rhodesia with Lewis & Marks.

H. BRERETON BAKER has been appointed professor of chemistry in the Imperial College of Science and Technology.

ALFRED E. BARLOW has been elected president of the Canadian Mining Institute.

J. MACKINTOSH BELL has joined the staff of L. Ehrlich & Co., as consulting geologist.

H. C. BELLINGER, manager of the Great Cobar, has been elected president of the Australasian Institute of Mining Engineers.

R. S. BOTSFORD is at Vladivostok for Bainbridge, Seymour & Co.

M. H. BURNHAM has returned from Mexico.

GEORGE B. BUTTERWORTH is on his way to Colombia.

J. MORROW CAMPBELL has gone to Norway.

E. J. CARLYLE has resigned as manager of the Kyshtim smelting works, Siberia, and has returned to America.

A. H. CASE has been appointed manager for the Tennessee Copper company.

C. W. CHATER has left for Northern Nigeria.

EDGAR A. COLLINS is on his way to Pierce, Arizona, where he will undertake the opening of the Commonwealth mine.

GEORGE E. COLLINS has returned to Denver from England.

A. SPENCER CRAGOE has been appointed manager of the Calamon mine in the south of Spain.

ROBERT E. CRANSTON has opened an office as consulting engineer at San Francisco.

G. D. DELPRAT is on his way back to Australia.

FRANCIS DRAKE is on his way to Bulawayo.

SELWYN GOLDSTEIN has left for Honduras.

W. P. HAMMON is in London.

E. MACKAY HERIOT has returned to London from Honduras.

HIRAM W. HIXON has been appointed metallurgist to the Teziutlan Copper Co., Puebla, Mexico.

ROSS B. HOFFMANN is here from San Francisco.

BERTRAM HUNT left London on April 10 for Nigeria.

J. P. HUTCHINS is at Vladivostok.

CHARLES JANIN, of San Francisco, is in London.

HOWARD JOHNSON has returned to Northern Nigeria.

HARRY R. JOHNSON is in London from Los Angeles.

H. A. LEWIS left on March 23 for Bolivia to take charge of the Berenguela tin mine.

T. LARSEN, lately of Waihi, has joined the staff of the Spassky copper mine, Siberia.

HENRY LAVERS, metallurgist to the Minerals Separation at Broken Hill, is in London.

ROSS K. MACARTNEY, late chief engineer of the Mount Bischoff mine, has been appointed manager for the Cornwall Tailings Co., Carn Brea.

R. B. NICOLSON, manager of the Ivanhoe mine, Kalgoorlie, is on his way to London.

K. C. NICHOLS has returned to Northern Nigeria.

R. W. PARTRIDGE has returned from Northern Nigeria.

C. W. PURINGTON has severed his connection with Orsk Goldfields.

R. J. D. RICHARDSON, manager of the Bibiani mine, is back from West Africa on leave.

E. J. RICHES has left England to manage mines in Greece.

W. R. RUMBOLD has returned to London from Northern Nigeria.

A. W. STICKNEY, of the United States Geological Survey, has been appointed geologist to the Kyshtim Corporation, Siberia.

ARTHUR THOMAS has returned from Mexico to Falmouth.

H. W. TURNER has returned from San Francisco to London.

R. C. N. TWITE has left for Nigeria on behalf of Bainbridge, Seymour & Co.

E. C. VIGEON has left London for the United States.

J. A. WAUCHOPE has been appointed consulting engineer to the Tasman & Crown Lyell Extended company.

S. J. WEIS is in London from the West Coast of Africa.

POPE YEATMAN has been examining the property of the Ray Consolidated Copper Co., Arizona.

# CONCENTRATION ANALYSIS FROM CANANEA PRACTICE

By ALFRED TELLAM.

THE figures given in this article are taken from the practice at the concentration plant of the Cananea Consolidated Copper Company, Sonora, Mexico, and particularly of that portion of it known as Section C Mill No. 2, which section was built to handle 700 tons dry weight of mixed ores crushed to a one-inch ring.

The ore is received into bins marked (*1*) on the accompanying flow-sheet, in addition to which there is an overflow bin (*6*). From these it is taken by the conveyors (*2*), (*3*), (*4*) and (5) to be automatically sampled at the sampler (*7*) where the following chemical and screen analyses were obtained:

| Cu. | Fe. | S. | Ag. | Au. |
|---|---|---|---|---|
| 2·88 | 11·2 | 12·0 | 0·4 | trace |

700 tons, at 2·88% Cu, gives 20·160 tons copper as the original content of the ore treated in one day.

| | Percentage weight | Tons per day | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On $\frac{5}{8}$ in. ... | 24·0 | 168·0 | 2·76 | 4·637 |
| On $\frac{3}{8}$ in. ... | 11·0 | 77·0 | 1·76 | 1·355 |
| On $\frac{8}{16}$ in. ... | 11·5 | 80·5 | 2·00 | 1·610 |
| On 2 m.m. ... | 8·8 | 61·6 | 2·50 | 1·540 |
| Through 2 m.m. trommel | 44·7 | 312·9 | 3·53 | 11·045 |
| Total feed ... | 100·0 | 700·0 | 2·88 | 20 187 |

From the conveyors the ore is discharged to the two trommels No. 8, having $\frac{5}{8}$ in. holes, where water is added to the extent of 108 gallons per minute. From these trommels the resultant products are 24% of oversize or 168 tons of feed to the coarse jigs (*9*), and 76% of undersize or 532 tons to the $\frac{3}{8}$ in. trommels (*13*).

In these jigs with the addition of 96 gallons of water per minute the concentration is as follows:

| | Tons | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 168·000 | 2·76 | 4·637 | 4·984 into 1 | 38·66 |
| Concentrate | 33·704 | 5·32 | 1·793 | | |
| Tailing ... | 134·296 | 2·28 | 2·844 | | |

The concentrate here as elsewhere in this analysis is a finished product. The tailing joins the feed to the $\frac{3}{8}$ in. trommel, after first passing to the Cole shovel-wheel (*10*), where 2 tons of slime sink to the spitzkasten beneath, leaving 132·3 tons to go to the coarse rolls (*11*). These rolls are set to crush to $\frac{1}{2}$ in. ring, 25 gallons of water being added per minute, and the material then raised by the elevator (*12*) to join the feed to the $\frac{3}{8}$ in. trommels. The screen analyses of the material elevated is as follows:

| | Percentage weight | Tons | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On $\frac{3}{8}$ in. ... | 44·4 | 59·595 | 2·64 | 1·573 |
| On $\frac{8}{16}$ in. ... | 31·5 | 42·262 | 1·60 | 0·646 |
| On 2 m.m. ... | 11·7 | 15·786 | 2·00 | 0·316 |
| Through 2 m.m. ... | 12·4 | 16·657 | 1·85 | 0·309 |
| | 100·0 | 134·300 | 2·28 | 2·844 |

The total feed to the $\frac{3}{8}$ in. trommels is therefore 532 tons undersize from the $\frac{5}{8}$ in. trommels and 134·296 tons tailing from the coarse jigs, or 666·296 tons, which becomes sized as follows, the oversize going to the jigs (*14*) and the undersize to the $\frac{8}{16}$ in. trommel (*18*).

| Tons | Percentage on $\frac{3}{8}$ in. | Tons on $\frac{3}{8}$ in. | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| 532·000 | 11·00 | 77·000 | 1·76 | 1·355 |
| 134·296 | 44·40 | 59·595 | 2·64 | 1·573 |
| 666·296 | 20·35 | 136·595 | 2·31 | 2·928 |

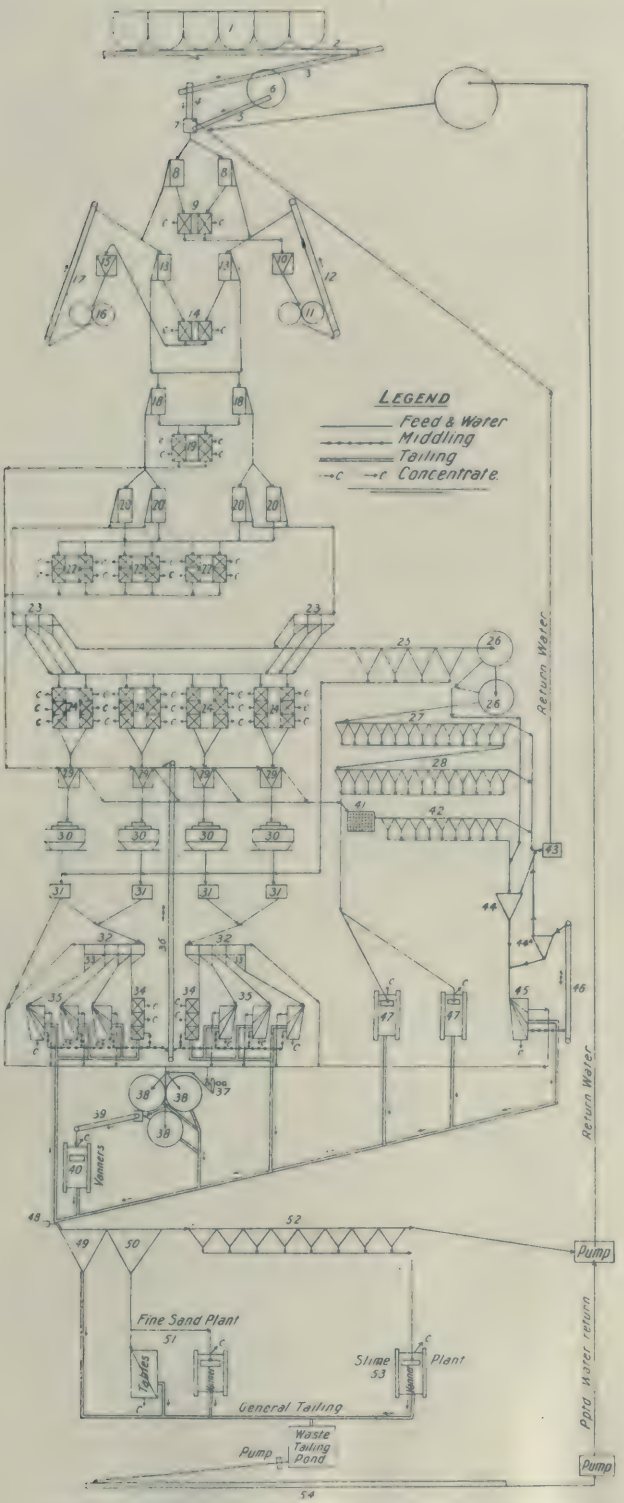
In the jigs (*14*) the concentration is as follows:

| | Tons | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 136·595 | 2·31 | 2·928 | 8·942 into 1 | 30·39 |
| Concentrate | 15 275 | 5·82 | 0·890 | | |
| Tailing ... | 121·320 | 1·68 | 2·038 | | |

The tailing from the above jigs, including also the hutch product, passes through the fine rolls (*16*) to be returned to the $\frac{3}{8}$ in. trommel, the oversize again going to the jigs and so on until it eventually passes the $\frac{3}{8}$ in. trommel or is taken off as concentrate. It is fed to these rolls by the Cole shovel-wheel (*15*) where 2 tons are drawn off in the spitzkasten below and sent to the elevator (*17*), 119 tons being shovelled to the rolls before being elevated. The screen analysis of this material is as follows:

| | Percentage weight | Tons | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On $\frac{3}{8}$ in. ... | 25 2 | 30·572 | 1·50 | 0·458 |
| On $\frac{8}{16}$ in. ... | 48·0 | 58·235 | 1·70 | 0·990 |
| On 2 m.m. ... | 20·0 | 24·264 | 1·64 | 0·398 |
| Through 2 m.m. ... | 6·8 | 8·249 | 2·32 | 0·192 |
| Total feed ... | 100·0 | 121·320 | 1·68 | 2·038 |

The total feed to the $\frac{8}{16}$ in. trommels is 651·021 tons from which, 32 gallons of water per minute being added, an oversize having the following details is sent to the intermediate coarse jigs (*19*) while the undersize passes to the trommels (*20*).




FLOW-SHEET OF SECTION C MILL No. 2, CANANEA.

| | Tons | Percentage Copper | Tons Copper |
|---|---|---|---|
| Coarse roll product | 42·362 | 1·60 | 0·646 |
| Fine roll product | 58·235 | 1·70 | 0·990 |
| Original feed | 80·500 | 2·00 | 1·610 |
| Total ... | 181·097 | 1·79 | 3·246 |

In these jigs, 70 gallons of water per minute being added, the concentration is as follows:

| | Tons | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 181·097 | 1·79 | 3·246 | 9·02 into 1 | 35·36 |
| Concentrate | 20·077 | 5·72 | 1·148 | | |
| Tailing ... | 161·020 | 1·30 | 2·098 | | |

In this case the hutch product is treated as concentrate. The tailing is passed by the shovel wheel (*29*) to the Bryan mills (*30*).

Up to this point the material taken from the original feed of 700 tons is as follows:

| | Tons |
|---|---|
| 1st jig concentrate ... ... | 33·704 |
| 2nd ,, ... ... | 15·275 |
| Intermediate jig feed ... ... | 181·097 |
| Total ... | 230·076 |

This figure leaves 469·924 tons to proceed to the 2 m.m. trommels from which the oversize having the details given below, goes to the jigs (*22*), while the undersize, 368·274 tons, is sent to the hydraulic classifiers (*23*).

| | Tons | Percentage Copper | Tons Copper |
|---|---|---|---|
| Original feed ... | 61·600 | 2·50 | 1·540 |
| Coarse roll product | 15·786 | 2·00 | 0·316 |
| Fine roll product ... | 24·264 | 1·64 | 0·398 |
| Total ... | 101·650 | 2·22 | 2·254 |

In these jigs the concentration is as follows:

| | Tons | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 101·650 | 2·21 | 2·254 | 4·60 into 1 | 56·25% |
| Concentrate | 22·097 | 5·74 | 1·268 | | |
| Tailing ... | 79·553 | 1·24 | 0·986 | | |

In this case also the hutch product is considered as concentrate. The tailing goes to the shovel wheels (*29*) and then to the Bryan mills (*30*).

The amount of material sent to the hydraulic classifiers is 368·274 tons to which 120 gallons of water per minute is added as hydraulic water. The screening analysis of the material is as follows, to which it must be added that the solids constitute 19·5% of the pulp:

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 20 mesh ... ... | 8·0 | 29·462 | 3·86 | 1·137 |
| On 60 ,, ... ... | 26·0 | 95·751 | 5·03 | 4·071 |
| On 100 ,, ... ... | 10·0 | 36·827 | 4·30 | 1·884 |
| On 200 ,, ... ... | 8·0 | 29·462 | 4·50 | 1·326 |
| Sands through 200 mesh | 13·0 | 47·875 | 4·62 | 2·210 |
| Slime ... ... | 35·0 | 128·897 | 1·70 | 2·199 |
| Soluble Copper in 700 tons feed ... | — | — | 0·14 | 0·980 |
| Total ... | 100·0 | 368·274 | 3·64 | 13·807 |

These classifiers deliver the following products, that from the spigots going to the fine jigs (*24*), while the overflow goes to the spitzkasten (*25*).

| | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|
| Spigots ... ... | 177·261 | 4·34 | 7·695 |
| Overflow ... ... | 191·013 | 2·68 | 5·132 |
| | 368·274 | 3·64 | 12·827 |

In the fine jigs the concentration is as follows, the tailing going to the Bryan mills:

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 177·261 | 4·34 | 7·695 | 1·91 into 1 | 80·55 |
| Concentrate | 92·806 | 6·68 | 6·199 | | |
| Tailing ... | 84·455 | 1·77 | 1·496 | | |

The amount of material leaving No. 23 and entering the spitzkasten (*25*) is 191·013 tons which is separated into a spigot discharge of 24% and an overflow of 76%.

The spigot discharge containing 16·8% of solids and having the following screen analysis is sent to (*31*), the dewatering box below the Bryan mills:

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 100 mesh... ... | 22·0 | 10·085 | 3·80 | 0·383 |
| On 200 ,, ... | 20·4 | 9·352 | 3·85 | 0·360 |
| Through 200 mesh | 12·6 | 5·776 | 4·63 | 0·267 |
| Slime ... ... | 45·0 | 20·630 | 1·82 | 0·375 |
| Total ... | 100·0 | 45·843 | 3·02 | 1·385 |

The overflow containing 8·2% of solids and having the following screen analysis is sent to the pulp thickener (*26*).

| | Per centage weight | Tons solid | Per centage Copper | Tons Copper |
|---|---|---|---|---|
| On 100 mesh ... | 15·4 | 22·387 | 2·42 | 0·541 |
| On 200 ,, ... | 2·8 | 4·020 | 3·83 | 0·154 |
| Through 200 mesh | 21·0 | 30·517 | 4·66 | 1·424 |
| Slime ... ... | 60·8 | 88·246 | 1·85 | 1·635 |
| Total ... | 100·0 | 145·170 | 2·58 | 3·754 |

From this thickener there is a spigot discharge of 21·5% and an overflow of 79·5%. The former with 14·6% of solids and having the following analysis, is sent to the tables (*45*).

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 100 mesh ... | 18·0 | 5·617 | 3·40 | 0·191 |
| On 200 ,, ... | 7·6 | 2·372 | 3·85 | 0·091 |
| Through 200 mesh | 22·8 | 7·116 | 4·60 | 0·327 |
| Slime ... ... | 51·6 | 16·106 | 2·30 | 0·371 |
| Total ... | 100·0 | 31·211 | 3·14 | 0·980 |

The overflow containing 6·2% of solids and having the following analysis, is sent to the spitzkasten (*27*) and (*28*) from which the thickened spigot discharge is sent to the tables (*47*).

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 100 mesh ... | 14·71 | 16·770 | 2·09 | 0·350 |
| On 200 ,, ... | 1·44 | 1·648 | 4·00 | 0·066 |
| Through 200 mesh | 20·53 | 23·401 | 4·68 | 1·097 |
| Slime ... ... | 63·32 | 72·140 | 1·75 | 1·261 |
| Total ... | 100·00 | 113·959 | 2·38 | 2·774 |

Returning to the wheel (*29*), this handles 325·028 tons of jig tailing from the following sources and having the following analysis:

| | Tons | Percentage Copper | Tons Copper |
|---|---|---|---|
| From (*19*) ... | 161·020 | 1·30 | 2·098 |
| „ (*22*) ... | 79·553 | 1·24 | 0·986 |
| „ (*24*) ... | 84·455 | 1·77 | 1·496 |
| Total ... | 325,028 | 1·41 | 4·580 |

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 2 m m. ... | 58·4 | 190·052 | 1·22 | 2·329 |
| On 20 mesh ... | 4·1 | 13·344 | 1·20 | 0·160 |
| Through 20 mesh ... | 37·5 | 121·632 | 1·72 | 2·091 |
| Total ... | 100·0 | 325·028 | 1·41 | 4·580 |

Of this material 18% overflows as slime and fine sand which is sent through the sieve (*41*) to the spitzkasten (*42*), while the remaining 82% is sent to the Bryan mills. It is interesting to remark that 1200 lb. of chips is removed daily from the above sieve.

These Bryan mills are fed with 266·522 tons from wheel (*29*) and 25 tons of the middling from the Wilfley tables, making a total tonnage of 291·522. The amount of middling is not considered in the extraction until it is separated as concentrate or tailing, these being the only two products of the whole concentration plant. The screen analysis of the remaining material is as follows:

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 2 m.m. ... | 71·3 | 190·052 | 1·22 | 2·329 |
| On 20 mesh ... | 5·0 | 13·344 | 1·20 | 0·160 |
| Through 20 mesh ... | 23·7 | 63·126 | 1·72 | 1·085 |
| Total ... | 100·0 | 266·522 | 1·58 | 3·574 |

From the Bryan mills this material having then the following analysis is delivered to the dewatering boxes (*31*).

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 20 mesh ... | 1·9 | 5·064 | 0·48 | 0·243 |
| On 60 „ ... | 19·0 | 50·639 | 0·70 | 0·354 |
| On 100 „ ... | 16·0 | 42·643 | 1·24 | 0·529 |
| On 200 „ ... | 13·9 | 37·046 | 1·56 | 0·578 |
| Through 200 mesh... | 8·2 | 21·855 | 2·15 | 0·471 |
| Slime ... ... | 41·0 | 109·275 | 1·28 | 1·399 |
| Total ... | 100·0 | 266·522 | 1·58 | 3·574 |

These dewatering boxes take also the spigot discharge from (*25*), the two materials contributing as follows:

| | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|
| Bryan mill discharge | 266·522 | 1·58 | 3·574 |
| Spigot discharge (*25*) | 45·843 | 3·02 | 1·385 |
| Total ... | 312·365 | 1·59 | 4·959 |

92% of this total is drawn off through the spigot and fed to the hydraulic classifiers (*32*) while the remaining 8% overflows to the round tanks (*38*), the further details of this separation being as follows:

| | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|
| To classifiers (*32*) ... | 287,376 | 1·56 | 4·483 |
| To Round tanks (*38*) | 24,989 | 1·90 | 0·476 |
| Total ... | 312·365 | 1·59 | 4·959 |

In the classifier hydraulic water is added at the rate of 150 gallons per minute reducing the solids to 12·89%, of which the screen analysis is as follows:

| | Percentage weight | Tons solid | Percentage copper | Tons Copper |
|---|---|---|---|---|
| On 20 mesh ... | 4·0 | 11·495 | 0·64 | 0·073 |
| On 60 „ ... | 18·0 | 51·727 | 1·68 | 0·869 |
| On 100 „ ... | 11·0 | 31·611 | 1·78 | 0·562 |
| On 200 „ ... | 19·0 | 54·601 | 1·65 | 0·901 |
| Through 200 mesh | 10·0 | 28·737 | 3·00 | 0·862 |
| Slime ... ... | 38·0 | 109·205 | 1·11 | 1·216 |
| Total ... | 100·0 | 287·376 | 1·56 | 4·483 |

The classification effected sends the spigot discharge to the fine jigs (*34*) or to the Wilfley tables (*35*), while the overflow goes to the spitzkasten (*33*), the further details of this separation being as follows:

| | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|
| Feed ... ... | 287·376 | 1·56 | 4·483 |
| Spigot discharge ... | 117·240 | 1·93 | 2·270 |
| Overflow ... ... | 170·136 | 1·30 | 2·213 |

This spitzkasten separates 50,420 tons for the tables (*35*) and sends 119·716 tons of overflow to the centrifugal pump (*37*).

The material from the first spigot of (*32*) is fed separately to the fine jigs (*34*) where the following concentration is effected, the tailing being sent to the launder and the Scobey sampler (*48*).

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 48·250 | 1·80 | 0·868 | 5·36 | |
| Concentrate | 9·000 | 5·90 | 0·531 | into 1 | 60·47 |
| Tailing ... | 39·250 | 0·86 | 0·337 | | |

The material going to the Wilfley tables consists of 119·410 tons of classifier and spitzkasten sand from (*32*) and (*33*) which is concentrated as follows:

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 119·410 | 1·84 | 2·204 | 7·024 | |
| Concentrate | 17·000 | 7·60 | 1·292 | into 1 | 58·62 |
| Sand tailing | 76·430 | 0·81 | 0·619 | | |
| Head water | 25·980 | 1·13 | 0·319 | | |

The middling from these tables is returned by means of the elevator (*36*) to the Bryan mills and re-ground, no separation of such a product being therefore here recorded. The tailing goes direct to the launder (*48*), while the head water goes to the centrifugal pump (*37*) or to the round tanks (*38*).

This centrifugal pump takes 119·716 tons from (*33*) and 25·980 tons head-water slime

from (*35*), thus delivering 145·696 tons to the round tanks (*38*), the further details of these materials being given in the following statement:

| | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|
| Wilfley head-water slime ... | 25·980 | 1·23 | 0·319 |
| Overflow from spitzkasten (33) | 119·716 | 1·17 | 1·414 |
| Total ... ... | 145·696 | 1·19 | 1·733 |

To these figures 24·989 tons from (*31*) are added making a total of 170·685 tons, though it must be remarked that the material from (*31*) is not considered here as additional to the other figures.

From these tanks this tonnage after settlement is delivered by the elevator (*39*) to the vanners (*40*), the pulp containing 9·4% solids having the following screen analysis:

| | Percentage weight | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|---|
| On 60 mesh ... | 4·4 | 6·410 | 0·42 | 0·027 |
| On 100 ,, ... | 7·0 | 10·198 | 0·78 | 0·071 |
| On 200 ,, ... | 27·0 | 39·317 | 1·00 | 0·393 |
| Through 200 sand ... | 12·0 | 17·483 | 2·19 | 0·383 |
| Slime ... ... | 49·6 | 72·268 | 1·19 | 0·859 |
| Total ... | 100·0 | 145·696 | 1·19 | 1·733 |

The concentration effected by the vanners is as follows, the tailing going to the launder:

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 145·696 | 1·19 | 1·733 | 11·48 into 1 | 53·23 |
| Concentrate | 12·691 | 7·26 | 0·921 | | |
| Tailing ... | 133·005 | 0·60 | 0·812 | | |

As stated before the overflow from the wheel (*29*) amounting to 58·505 tons goes to the spitzkasten (*42*). From this a spigot discharge of 50 tons is sent through the classifier (*44*) to the Wilfley tables (*45*), while the overflow of 8·505 tons goes to the triplex pump (*43*) to be delivered to the head of the mill. This pump also handles 400 gallons per minute from the elevator (*46*), through the classifier *44a*.

In addition to the 50·000 tons from spitzkasten (*42*) the spigot discharge from (*26*) amounting to 31·211 tons also goes through (*44*) to the Wilfley tables (*45*), making a total feed of 81·211 tons, which is concentrated as follows:

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 81·211 | 2·03 | 1·630 | 9·64 into 1 | 48·03 |
| Concentrate | 8·517 | 9·20 | 0·783 | | |
| Tailing ... | 72·694 | 1·20 | 0·847 | | |

The tailing goes to the launder while the middling product is returned again by means of the elevator (*46*) till it passes out either as concentrate or tailing.

The spigot discharge from (*28*) amounting to 113·959 is passed over the vanners (*47*) where the following concentration is effected, the tailing going to the launder:

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 113·959 | 2·38 | 2·774 | 8·14 into 1 | 38·68 |
| Concentrate | 10·200 | 10·52 | 1·073 | | |
| Tailing ... | 103·759 | 1·63 | 1·701 | | |

As beyond this stage the operations of Section C of this mill are not kept separate from those of the other sections, a summary of the results to this stage are here given:

SUMMARY OF EXTRACTION.

| Machine | Tons Conc'tes | Percentage Copper | Tons Copper | Distribution of extraction per-centage of whole saved |
|---|---|---|---|---|
| Jig *9* ... | 33·704 | 5·32 | 1·793 | 11·27 |
| ,, *14* ... | 15·275 | 5·82 | 0·890 | 5·59 |
| ,, *19* ... | 20·077 | 5·72 | 1·148 | 7·22 |
| ,, *22* ... | 22·097 | 5·74 | 1·268 | 7·97 |
| ,, *24* ... | 92·806 | 6·68 | 6·199 | 39·00 |
| ,, *34* ... | 9·000 | 5·90 | 0·531 | 3·34 |
| Wilfley *35* ... | 17·000 | 7·60 | 1·292 | 8·12 |
| Vanner *40* ... | 12·691 | 7·26 | 0·921 | 5·79 |
| Wilfley *45* ... | 8·517 | 9·20 | 0·783 | 4.92 |
| Vanner *47* ... | 10·200 | 10·52 | 1·073 | 6·72 |
| | 241·357 | 7·00 | 15·898 | 100·00 |

These figures show that to this point a ratio of concentration 2·90 into 1 was achieved, together with an extraction of 77·07 per cent.

SUMMARY OF TAILINGS.

| Machine | | Tons | Per centage Copper | Tons Copper |
|---|---|---|---|---|
| Jig | (*34*) ... | 39·250 | 0·86 | 0·337 |
| Wilfley | (*35*) ... | 76·430 | 0·81 | 0·619 |
| Vanner | (*40*) ... | 133·005 | 0·60 | 0·812 |
| Wilfley | (*45*) ... | 71·694 | 1·20 | 0·847 |
| Vanner | (*47*) ... | 103·759 | 1·63 | 1·701 |
| Overflow | (*38*) ... | 34·504 | 1·20 | 0·414 |
| | | 458·643 | 1·03 | 4·730 |

From the sampler this tonnage is discharged to the coarse sand tank (*49*) which, with a spigot discharge of $\frac{7}{8}$ in. diam. effects the following classification upon the total material from two sections of this concentrating plant:

| | Tons solid | Percentage Copper | Tons Copper |
|---|---|---|---|
| Total tailing ... ... | 905·287 | 1·03 | 9·324 |
| Spigot discharge ... | 292·678 | 0·65 | 1·902 |
| Overflow ... ... | 612·609 | 1·21 | 7·412 |

The spigot discharge is sent to the settling pond while the overflow passes to tank (*50*) where, with spigots $\frac{1}{2}$ in. diameter, the following classification is made:

| | Tons solid | Per centage Copper | Tons Copper |
|---|---|---|---|
| Overflow from (*49*) ... | 612·609 | 1·21 | 7·412 |
| Fine discharge ... | 127·102 | 0·90 | 1·144 |
| Slime overflow ... | 485·507 | 1·29 | 6·268 |

This fine discharge together with that from mill No. 1 are fed into an hydraulic classifier, from which the coarse product goes to the Card tables and the fine to the vanners of the fine sand plant (*51*). This plant treats 268 tons daily with the following results:

CARD TABLES.

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 53·000 | 0·98 | 0·519 | 23·47 into 1 | 24·74 |
| Concentrate | 2·258 | 5·70 | 0·128 | | |
| Tailing ... | 50·742 | 0·77 | 0·391 | | |

| | | | | | |
|---|---|---|---|---|---|
| | | Frue Vanners. | | | |
| Feed ... | 215·000 | 1·12 | 2·408 | { 27·06 | |
| Concentrate | 7·945 | 9·20 | 0·731 | { into 1 | 30·35 |
| Tailing ... | 208·055 | 0·81 | 1·667 | | |

The tailing in each case goes to the settling ponds from whence clear water is returned to the precipitating plant.

The overflow from (*50*) passes into the V-bottom tanks (*52*) which take the material from four sections of the concentrating plant.

From these 975 tons of absolute slime at 1·04% copper or 10·140 tons is separated and 1500 gallons of clear water per minute returned to the sump. All dirty water is added to one end of each of the four sections and allowed to overflow from one compartment to the next until clear water is discharged to the sump, to be pumped from there to the head of the mill.

From the total of slime separated only the 460 tons discharged from the first spigots is passed over vanners, the resulting concentration being as follows:

| | Tons solid | Percentage Copper | Tons Copper | Ratio | Percentage Extraction |
|---|---|---|---|---|---|
| Feed ... | 460·000 | 1·16 | 5·336 | { 34·32 | |
| Concentrate | 13·403 | 7·53 | 1·009 | { into 1 | 18·90 |
| Tailing ... | 446·597 | 0·97 | 4·327 | | |

Using these supplementary figures the further extraction made on 458,643 tons of tailing is as follows:

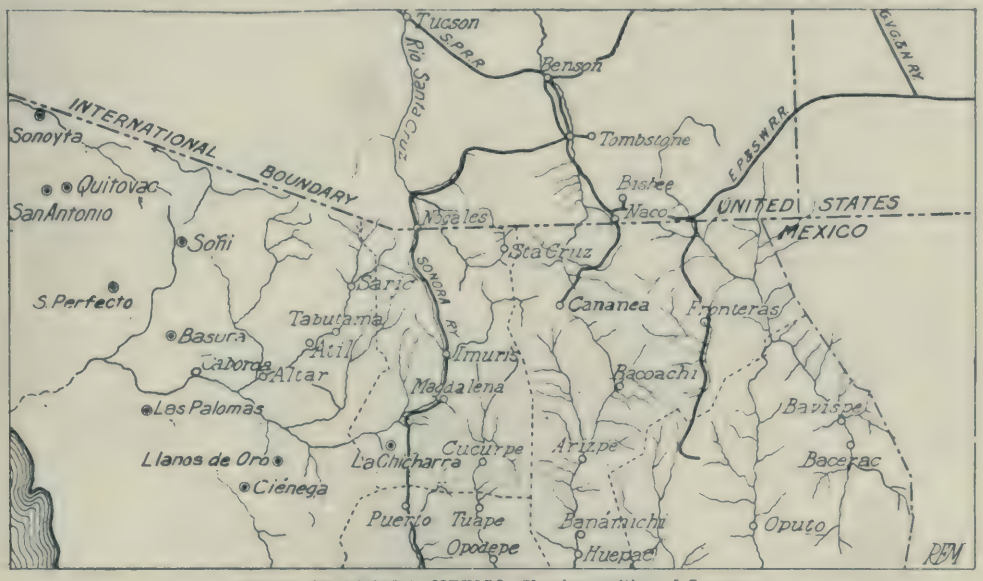
| | Tons Concentrate | Percentage Copper | Tons Copper |
|---|---|---|---|
| Card tables (*51*) ... | 0·537 | 5·70 | 0·031 |
| Sand vanners (*51*) ... | 1·891 | 9·20 | 0·174 |
| Slime vanners (*53*) ... | 3·350 | 7·53 | 0·254 |
| | 5·778 | 7·94 | 0·459 |

At the same time the final segregation of the copper in the tailings becomes:

| | Tons | Percentage Copper | Tons Copper |
|---|---|---|---|
| Coarse sand tank (*49*)... | 146·339 | 0·65 | 0·951 |
| Fine sand plant (*51*)... | 64·670 | 0·78 | 0·504 |
| Slime plant (*53*)... | 241·856 | 0·97 | 2·346 |
| | 452·856 | 0·84 | 3·801 |

The water recovered at different points after passing the sampler is as follows:

| | Gal per min. |
|---|---|
| Settling system (*52*) ... ... | 1500 |
| Fine sand and slime plants (*51*) and (*53*) | 400 |
| Coarse sand tailing ... ... | 1100 |
| Total water recovered from tailing ... | 3000 |
| Overflow concentrate bins ... ... | 900 |
| Making a total water recovered ... | 3900 |




*STATE OF SONORA, MEXICO, Showing position of Cananea.*

Of this amount 1500 gallons passes through the precipitating plant (*54*) which consists of a series of launders in which scrap iron is laid. The water at the head of this plant contains 1·25 lb. copper per 1000 gallons of water, 85% of which is precipitated on the iron. With this the final rate of concentration for the whole process becomes 3·02 into 1, and the total extraction 80·3% of the copper in the ore.

With 0·84% of copper in the tailing discharged the above mill practice shows itself to be practically as good as could be done by very careful hand-work with a pan on coarse tailing and with a plaque on the fine.

At the time the mill was built, L. D. Ricketts was consulting engineer, and David Cole was superintendent of construction and operation.

# REINFORCED CONCRETE FOR STAMP FOUNDATIONS

By J. P. FULLER.

THE figures given in these notes relate to a 40-stamp mill built for the Simau mine in Sumatra. The mill as designed by the makers had a block of wood between the concrete foundation and the cast-iron anvil-blocks, but as no use could be seen for this it was omitted. These latter weighed 4·5 tons and the mortar boxes 3·5 tons. The falling weight of the stamps when new was 1320 lb. The forty stamps were to have been erected on a single concrete block, but in the place of this four reinforced blocks were made, each to carry ten stamps. One reason why the single-block scheme was rejected was that, as the site was not a particularly good one, local settlement would be likely to take place. Another reason was that, as the length of the block would have been more than 20 metres, unnecessary risk would be run unless some provision were made for expansion and contraction. Special arrangements also would have had to be made to complete the work without stopping after once it was started and this could not be done.

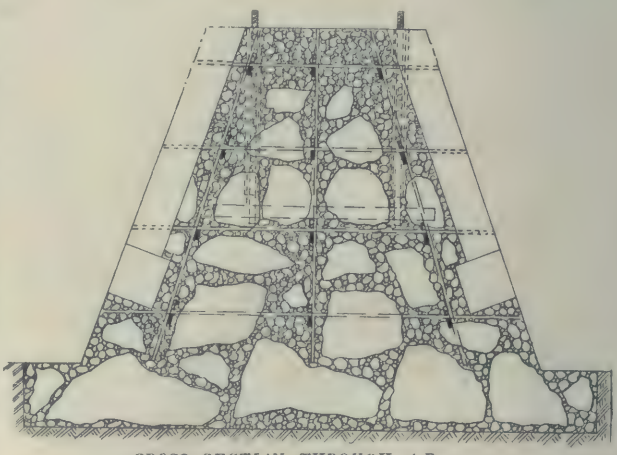
The bed-rock at the selected site was a decomposed andesite in which it was found necessary to lay primary foundations of heavy stones grouted in place with cement mortar. For each block 9 cubic metres of such primary foundation was laid, or a total of 36 cubic metres.

The cement used was Portland cement of good commercial quality, as expressed by the following determinations :

| | |
|---|---|
| Alkalinity in terms of $Ca(OH)_2$ | 3·68% |
| Soundness | Good |
| Grading | |
| + 80 | 2·15% |
| − 80 + 120 | 10·20% |
| − 120 + 150 | 18·20% |
| − 150 + 200 | 6·25% |
| − 200 | 63·20% |
| | 100·00% |

In the tests for soundness two small pats were made, one to which 25% of water had been added and the other to which 30% had been added. These pats were 3 in. in diameter and $\frac{1}{2}$ in. thick at the centre. They were mixed on glass and after having been covered with a damp cloth for 12 hours, were subjected to five hours' boiling in water while still upon the glass. After the water had cooled, these pats showed neither faults, cracks, nor blow-holes, and the cement was therefore considered sound. On ordinary masonry, if used rather rich, it generally showed fine cracks unless it could be kept damp for a very considerable time.

The river sand used weighed about 1350 kilograms per cubic metre and contained about 40·8% voids and 10% water. The gravel



*CROSS SECTION THROUGH A B.*

consisting of river pebbles from $\frac{1}{4}$ up to $2\frac{1}{2}$ in. weighed about 1560 kg. per cbm. with about 36·0% voids and 4% water.

The determination of voids was made by rather a rough but perfectly satisfactory method. An ordinary petroleum tin was weighed empty and its cubic content measured. When filled with sand or gravel the weight was again noted, and while still on the scales, water was added until it began to overflow, when the weight was noted once more. Weights were recorded in kilograms and as one kilogram of water occupies 1000 cc. the percentage of voids was thus easily obtained. This method being simple was easily understood by the workmen who applied it whenever there appeared to be a change in the material, the object always being to have a dense mixture.

The reinforcement consisted of flat mild steel bars of small dimensions crimped at intervals of 30 cm. In each block 12 of such pieces were put lengthwise, 20 crosswise and 15 standing, the weight of all these pieces being 265 kg. At the end of each piece a hole was punched, through which the hooked end of a rod was passed, this rod being long enough to pass through the wooden form and to provide by a bolt on its other end a means of keeping the reinforcement in position.

When the forms for the concrete were placed, the reinforcement was arranged by binding the pieces together and further secured in place by means of the rods mentioned above, which, in addition to bracing the forms against the bursting pressure due to the weight of the concrete, prevented them also from being lifted. Afterwards when the forms were struck, the short rods were easily removed and used for the next block. It was found that the blocks set reasonably quickly and it was possible to remove the forms within 48 hours from the time they were filled. The increase in temperature twelve hours after such filling was 17°C.

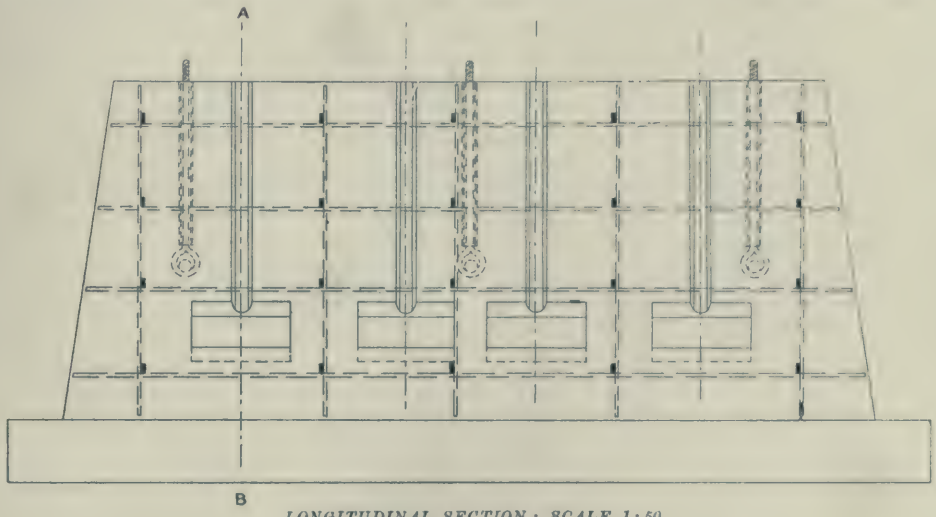
The proportions of cement, sand, and gravel were as follows:

| | Cement | Sand | Stone |
|---|---|---|---|
| Bottom Section | 1 | 3 | 6 |
| Second ,, | 1 | 3 | 5 |
| Third ,, | 1 | 2 | 4 |
| Fourth ,, | 1 | 2 | 3 |
| Top Section | 1 | 1·5 | 2 |

Before starting operations, a three-stage mixing platform was built with chutes connecting the floors. The top or dry-mixing floor was arranged so as to permit two gangs of coolies to be measuring and mixing at the same time. As a convenient unit of measurement for the dry-mixing, a set of four boxes was made, each box being 50 by 50 by 25 cm., or $\frac{1}{16}$ of a cubic metre.

The stone and sand collected from the river was wet enough to make the particles of cement adhere without the addition of water for that purpose. The sand and cement were first measured out and turned over together twice; the measured amount of stone was then added and the three materials turned over together before being shovelled down the chutes to the second mixing floor, the passage down the chutes assisting to mix the aggregate. Water was next added after which the aggregate was again turned over twice and then shovelled down a small chute to the third or final mixing floor, where water was carefully added to make what would be called a wet concrete. When this concrete was perfectly uniform it was shovelled into trucks, run to the forms and tipped carefully where required, then well tamped. Raking or other shifting of the concrete was, however, as far as possible avoided. About 3·5 cubic metres of large hand-spalls of clean, selected, hard andesite were added during the filling, principally in the bottom section of the blocks, none being added in the top half-metre. As far as possible these stones were kept from touching one another so that each was therefore well bedded in concrete. On massive work of this sort such spalls are quite justified and effect a real saving in cement.

On the form becoming full, some light foreign matter that had doubtless been entrapped




*LONGITUDINAL SECTION; SCALE 1:50.*

with the gravel and sand and also some calcium salts floated to the surface. By carefully placing a rather dry mixture in the last five centimetres of the form, most of this foreign matter, etc., was displaced, and the surface of the block thus guarded from any chance weakness which might otherwise have resulted. The filling of each block occupied about eight hours. The total volume of material, cement, sand, gravel, and stone measured separately and put into each block was 40 cubic metres, whereas each finished block measured 25 cbm. or 100 cbm. for the complete work. As the total cost of this work including every possible item which could be charged was £375, the cost per cubic metre was £3. 15s., towards which cement alone contributed £2. 13s., this material costing about £2 per barrel of 180 kg. delivered at the mine.

## APPLICATIONS OF OIL-FUEL

THE British Science Guild has published a pamphlet entitled the 'Natural Sources of Energy,' in which a large number of leading scientists review the subject concisely and in phraseology appealing to the average reader. Appearing as it does in the midst of the coal strike its pages are eagerly scanned for authoritative information as to possible substitutes. We give herewith a résumé of the views on petroleum presented by Sir Boverton Redwood. At the outset he warns his readers that the natural resources as regards oil-fuel are at the present time almost insignificant when compared with those of coal. Probably many people allow themselves to form an exaggerated view of the production of petroleum owing to the figures being given in barrels which contain about one-fifth of a ton, the production thus looming larger in their view than it should. It is appropriate therefore to quote Boverton and Eastlake's table of production for 1910 in metric tons as under :

| Country | Quantity Metric Tons |
|---|---|
| United States | 27,940,806 |
| Russia | 9,599,304 |
| Galicia | 1,762,560 |
| Eastern Archipelago | 1,435,240 |
| Roumania | 1,352,289 |
| British India | 808,794 |
| Mexico | 444,373 |
| Japan, including Formosa | 257,021 |
| Peru | 177,347 |
| Germany | 145,168 |
| Canada | 43,129 |
| Italy | 6,000* |
| Hungary | 2,500* |
| Other Countries | 12,000* |
| Total | 38,052,233 |

* Estimated.

During the same year 1910, the estimated output of coal throughout the world was 1,035,000,000 tons, as recorded in our February issue. It will be seen that the figures for coal and oil will stand no comparison.

At the present time there is a greater demand than supply for 'petrol,' that is, the highly volatile constituent of petroleum. Only a comparatively few occurrences of petroleum contain this volatile oil, and not more than 5% of the world's production is in the form of petrol. Many of the heavier oils are used for steam-raising purposes, but this is a wasteful method of utilizing their heat; the advent of the Diesel oil engine will have an important influence on this application of heavy oil. In many cases it is possible to substitute ordinary kerosene for petrol in gas engines, and seeing that about 50% of the oil output of crude oil can be recovered in this form there might be an application for it in this direction if it were not for the fact that kerosene is in so great a demand for illuminating purposes. It must be remembered also that there is a strong demand for petroleum products for lubricating purposes. The general impression obtained by carefully considering these matters is that oil-fuel is not as dangerous a rival of coal as is often supposed.

## CONDITIONS IN THE YUKON

By GUY A. R. LEWINGTON.

AT a time when the mining laws and the methods of government of Alaska are exercising the minds of the citizens of the United States, it is opportune to give an account of the infinitely superior conditions in the Klondike district of the adjoining Yukon territory of Canada, and also to say something in favour of the climatic advantages of the inland districts of both countries. The conditions of life in Central Alaska and the Klondike are practically the same. The Klondike region, with Dawson as the central point, is under Canadian authority, while Alaska is governed by the United States Congress without any actual representation. The Yukon has its full-fledged Member of Parliament, its own wholly elective local council, and to all intents governs itself. The Government long ago realized that a territory larger by far than any other in Canada could not be satisfactorily administered from Ottawa and wisely placed the reins in the hands of the people who work and live in the Territory. The mining code which has been in operation since

1907 cannot be amended except by Act of Parliament, which means that before the code can be altered in any way the people will have time to express their opinions either for or against such change.

It is difficult to conceive a more liberal mining law than the one in force in the Yukon. Regardless of nationality any man or woman over eighteen years of age may locate either placer, quartz, coal, or any other mineral claim, and hold the same as securely as native-born Canadians. Placer claims are leased by the Government to the applicant for the sum of $10 per annum, payable in advance, which insures absolute title, as only one grant can be issued for the same piece of ground for the year in which it is in force; and upon compulsory affidavit covering necessary assessment work made at the expiration of the grant, or annual lease, a renewal grant is issued for another year.

Under this system, the litigation which has been, and still is, the curse of Alaska is not possible; 'jumping' is unknown and no suit can be brought against the holder of a grant, except on authority of the Attorney General of Canada, representing the lessor, and to secure his consent to begin such suit it must be clearly shown to his satisfaction that the contestant has legal reasons. Such suits are practically unknown. Quartz and other mineral claims (placer and coal excepted) may be Crown-granted, or patented as in the United States, and are under the leasing system until such time as the required amount of work has been accomplished to entitle them to patent. To secure patent to a mineral claim it must be conclusively shown that at least $500 has been expended on improvements, and that the claim has been properly surveyed, and advertised for a period of sixty days in the nearest newspaper. The required annual assessment work is $100, and upon affidavit to the effect that the work has been done, which work is subject to Governmental inspection, a certificate of work is issued which entitles the holder to an extension of his lease for one year. The survey of the claim may be included as assessment work for the year in which it is done. The lessee of a mineral claim, upon securing five certificates of work representing $500, one of which may be for surveying, may apply for a patent by submitting the five certificates of work to the proper authority. An order is then issued by the Government permitting the holder or lessee to have his claim advertised, and upon completion of the advertising, and payment of $1 for each acre contained in the claim also some minor office fees, and in case no adverse claim has been recorded prior to the expiration of the advertising period, a certificate of improvements is given. This certificate is equivalent to a patent and the claim is then withdrawn from the public lands. No further work on the part of the owner is necessary and the patent itself is issued in due time. The whole operation is simplicity itself and makes the red tape necessary in Alaska seem ridiculous.

Anyone visiting the coast of Alaska can have no conception of the magnificent country in the Yukon Territory lying behind the great barrier range of the coast. The climate of the Alaska coast is most disagreeable, but in the interior of Alaska and in the Yukon Territory the most severe weather is thoroughly pleasant. We read reports of extreme cold at outside points, of people freezing to death, while here we go about whatever has to be done without particular discomfort. Toronto reports 25° below zero, which degree of cold at this point is considered by all delightful weather; we see children of all ages rolling round in the snow having the time of their lives; they are of course warmly dressed, but then they can be out, play, thrive and come to no harm even at 35° below zero, and continue going to school in the coldest weather. On the night of February 15, an open air dance was held on the public school grounds at which fifteen hundred people of Dawson were present and enjoyed every minute of it. Onlookers wore their fur coats, but the dancers wore sweaters, short skirts, and mocassins. The dancing was on the snow, packed hard by the feet of the school children in their various games. At the same moment the people of Toronto and other cities in Canada and the United States were closely housed on account of the extremely severe weather. It must not be supposed however that the winters are never colder than this. On the contrary there are short periods when extreme cold is experienced. Temperatures of 60° and even 70° below zero occur with striking regularity for short periods of each winter; these however cause no great hardship as they are expected and provided for. The foregoing it is hoped will give some idea of the interior of Alaska and the Yukon, as a place where people live in comfort carry ing on their daily vocations much as they do in other cold climates which are closer in touch with the Greater Outside, and consequently better understood.

# EQUIPMENT AT PUSHING BHARU TIN MINES.

THE properties of the Pusing Bharu Tin Mines, Ltd., and the Siputeh Tin Mines, Ltd. are situated in the Malay Peninsula, district of Kinta, the nearest towns being Ipoh and Batu Gajah. The former company was registered in 1907 to acquire and work about 170 acres in this district, which contain low-grade tin deposits, the value of the mineral won from the Pusing Bharu property in 1909, the first complete year of working, being £41,147. The latter company owns about 200 acres in the same district.

The mines are worked electrically from a joint plant. The order for the electrical machinery was placed with the British Westinghouse Electric & Manufacturing company in 1907, through the contractors, the Wilfley Mining Machinery company. Erection work was begun in January 1908 and completed in the June following, when the mines started running. Some idea of the general surface conditions of the district may be gathered from the photograph, which shows, in general view, the hauling incline and puddler shed of the Siputeh mine. The power-house, situated about half-way between the two mines, contains three-phase, 50-period, 150-kw., 2200-volt, a.c. generators.

The transmission lines are each about one mile long. They feed into the Pusing Bharu sub-station which is equipped with six single-phase, 2200 : 440-volt. transformers, forming two groups of 150-kw. capacity each. From the sub-station there are two low-tension transmission lines, supplying a 3-phase, slip-ring induction motor, that drives an endless haulage.

*THE SIPUTEH TIN MINE, showing Incline-Haulage and Puddle-Shed.*

There are also two transmission lines feeding a 20-h.p., 945-r.p.m. squirrel-cage induction motor, direct coupled to a Worthington 6 in. turbine pump which has an output of 660 gal. per min. with a 60 ft. head, a motor of the same type and output, but of a higher speed (1400 r.p.m.) driving a Worthington 5 in. double-stage pump with an output of 375 gal. per min. against an 80 ft. head, and an overburden winch similar to the one already mentioned, driven by an 8-h.p. motor.

The tin-bearing material is loaded into trucks, and pulled up by an incline double-drum winch and endless haulage direct into the puddler shed. This winch is of 5 ft.

diameter, 2 ft. 6 in. face, driven by a 40-hp. motor equipped with a reversing controller. The ore is then dumped into a chute and monitored into the high-speed puddler, the water for monitoring being supplied by a Worthington 10 in. single-stage pump of 1333 gal. per min. output, with a 30 ft. head, driven by a 25-hp. squirrel-cage induction motor, direct coupled to it. The high-speed puddler consists of a shaft fitted with knives of forged steel which break up the large hard lumps of clay. This is belt-driven by a 25-hp. squirrel-cage induction motor. The clay then has a natural feed into the low-speed puddlers, driven by a similar motor, which break it up still finer. The overflow from the low-speed puddlers runs into the riffle races, which catch the tin as it escapes from the puddler and allow the tailing to flow into the settling pond. There are seventeen motors in use at Pusing Bharu, developing a total horsepower of 160. The Siputeh mine is of a similar character, but has only one incline to the puddling shed.

An interesting fact about this installation is that the entire electrical plant was erected, and has now been run for two years to the entire satisfaction of the company, by unskilled native labour under the supervision of one electrical engineer. This in spite of very adverse conditions, the motors being at all times exposed to wet and dirt in the puddling sheds, and in fact in all parts of the mine where the tin-bearing earth is handled.

## Continuous Rail-Laying Tractor.

The photograph on this page is of a tractor in commission between Port Augusta and the Mt. Gunson mine, South Australia. Its actual load at the time the photo was taken was 34 tons, consisting of cement, timber, tar, iron, etc. There are no roads between the port and the mine, only camel pads. Many miles had to be traversed through scrub up to six inches in thickness and with stems 20 feet high, which the train pushed down and walked over; loose drifting sand and sand hills with grades reaching 1 in 3½ had to be passed; creeks without fords or bridge had to be crossed. This was all done at an average speed of one mile an hour. Three men were in charge, bunks being provided for them on board. As it was travelling through a waterless desert, all water had to be carried for the out and home journey. The effect of the construction of the wheels is to lay a length of steel railway rails continuously under every wheel. The rails with their bed-plates are 4 ft. 6 in. long by 15 in. wide, and one bed-plate is always under the wheel. In practice the device is equivalent to a continuous railway track, over which the whole train runs smoothly, no matter how rough or uneven the ground. The total length of the trial trip was 250 miles, to traverse which 328 gallons of benzine was used. The cost, including fuel and lubricating oil, and wages for three men, was 2½d. per ton-mile. This compares with 1s. for horse, or camel loading.

*CONTINUOUS RAIL-LAYING TRACTOR.*

# AIR-LIFTING OF SLIME-PULP

By A. W. ALLEN.

THE direct use of air in the elevation of slime-pulp is a method growing in popularity, being especially suitable where in addition to the ordinary mechanical advantages the chemical advantage following upon aeration may also result.

Mechanically the ordinary air-lift has much to recommend it. It is practically free from wearing parts and can be installed in any locality to which an air-supply can be laid, and where a sump can be sunk below the intake level to a depth exceeding the height to which it is required to elevate the pulp. There are no packing joints and, in consequence, no necessity for the use of pressure clearing water or solution, with the attendant disadvantage of pulp dilution. The height to which pulp can be lifted in one lift depends on the available pressure of air, whereas the total lift is practically unlimited, depending only upon the number of times the single lift may be compounded. Even if erected in duplicate the initial outlay is small; a fair efficiency can be obtained in actual practice; and, in operation, no attention is needed since the whole arrangement can be made to operate automatically, even with a variable feed.

The principle underlying the action of the air-lift is a simple one and depends on the fact that a mixture of air and fluid is lighter than fluid alone. In practice the lifting action is maintained by the gradual expansion of the air from maximum to atmospheric pressure, the specific gravity of the mixture decreasing as it rises. The simplicity of the system is, too often, an incentive to its adoption without due consideration having been taken of the factors which affect efficiency of operation; and it is rather an unfortunate fact that excess of air may be used, to a large extent, as a remedy for defective design.

In the erection or working of an air-lift the following errors should be avoided:

(1) An insufficient or an excessive allowance in the ratio of submergence to lift.

(2) Lack of precautions providing for the intimate mixture of air and pulp at the lift intake.

(3) The use of bends or elbows in the discharge pipe.

(4) An unnecessary air pressure.

(5) Excessive volume of air.

(6) High velocity in the rising main.

In view of the importance of these questions in the matter of the efficiency of the system it is proposed to consider them individually, and in detail.

**Submergence.**—When the submergence of the lift pipe in the pulp is insufficient to satisfy an efficient ratio an excess of air will be necessary to perform the work. With an unnecessary submergence the air pressure required rises above the economical limit. Various ratios are in practice but it has been shown by a number of investigators and operators that a submergence of from $1\frac{3}{4}$ times to twice the required lift is the most efficient. On the East Rand Proprietary plant an efficiency of 39·5% of the indicated work in the steam cylinder of the compressor was obtained in an air-lift system with a submergence to lift in the ratio of 1·817 to 1[1]. Prof. Jossé, at Charlottenburg, obtained an efficiency of 44·9% of the indicated work in the compressor cylinder in the case of an air-lift with submergence to lift in the ratio of 2 to 1[2]. J. Kelly, at Preesall, in Lancashire, obtained an efficiency of over 38% of the indicated work in the steam cylinder of the compressor in the case of two sets of wells, each of three lifts, and with a ratio of submergence to lift of about 2 to 1[3].

In these three instances the height of lift above sump level varied from 25 to 110 feet. The East Rand results were obtained on a thin slime pulp; the others refer to the lifting of water only. From these figures it would seem that the correct ratio of submergence to lift is not dependent upon either the specific gravity of the fluid or the height required to elevate it.

The depth of submergence should where possible be maintained at a constant level. This can be done in many cases by means of a plug valve on the air supply, connected to a float in the manner shown in Fig. 1. Without such a device, and in the event of temporary diminution of supply, the pulp in the well would be lowered and more air would be necessary, the lift operating at a reduced submergence. On the other hand, a slight excess over the normal feed would, in the absence of a self-regulating device, result in the overflow

[1] *The Engineer*, January 10, 1908.
[2] *Zeitschrift des Vereins Deutscher Ingenieure*, 1898.
[3] Proc. Inst. Civ. Eng., Vol. 163, 1905–1906.

of the sump unless personal attention was available. The air-lift can however in some such manner as that indicated above be made to handle a variable feed with perfect regularity; and, in this respect alone, it shows itself to advantage over any other system of pulp elevation.

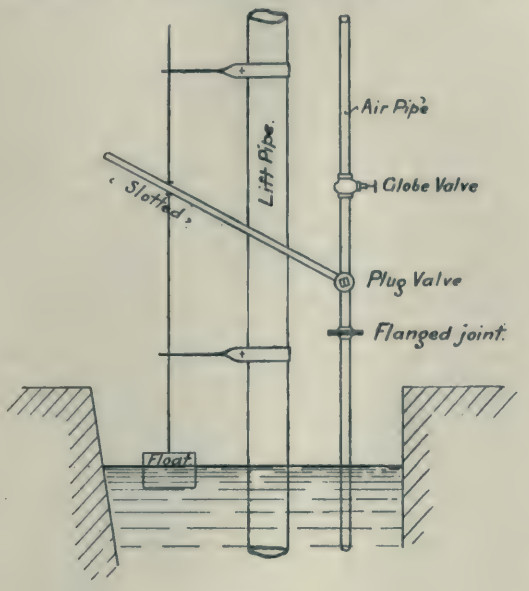



Fig. 1.

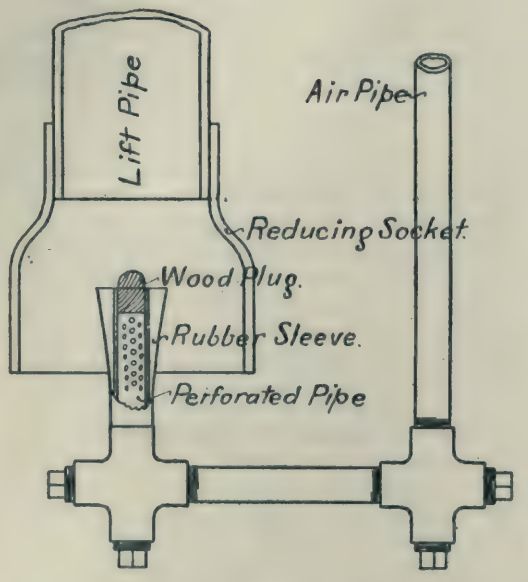



Fig. 2.

**Air Supply.**—Efficiency is largely dependent on the intimacy of the mixture of air and pulp at the commencement of lifting. To this end the air outlet may be nozzled, but the practice is liable to lead to chokage of the air pipe with hardened slime. The same effect can be obtained, and the air pipe incidentally kept free from solids, by plugging the outlet and allowing the air to escape from a number of slits or holes around the end of the pipe, the latter being covered with a short length of pure rubber hose, wired at the lower end, as shown in Fig. 2. The credit for this idea is, I believe, due to the introducers of the Pachuca vat, but I am open to correction on this point. Its value in any air-lifting or air-agitating device is considerable.

A single air jet will be sufficient for lift pipes up to six inches in diameter. In large systems it will be found necessary to distribute the air over as large an area as possible. In some instances it has been found advantageous to surround the lift pipe, just above the intake, with a hollow collar connected with the air supply. A number of perforations through the collar and the lift pipe then allow the air to escape around the whole circumference of the rising main. A most efficient arrangement for use with slime pulp, and large lifts, is shown in Fig. 3, with which there is little danger of chokage of the air supply.

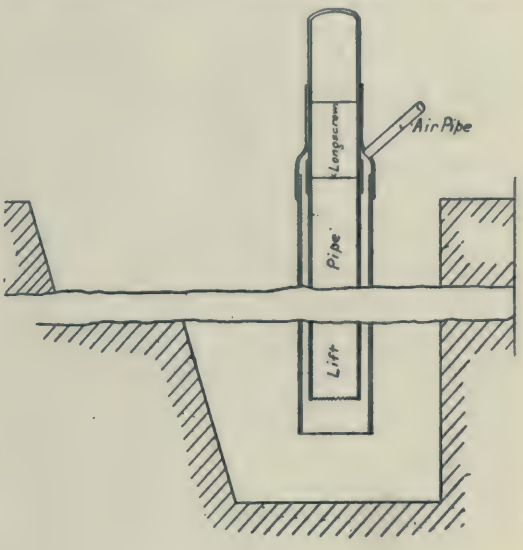



Fig. 3.

**Discharge Arrangements.**—All elbows and bends should be avoided in the lift pipe, which should deliver into the bottom of a short launder with a sharp fall. Any possible recompression of the air, after the lifting has been accomplished, will then be avoided.

**Air Pressure.**—The air pressure required

to start the lift will depend on the depth of submergence, and the specific gravity of the pulp. If ($H$) equals the submergence in feet, and ($S$) the specific gravity, then:

theoretical gauge pressure $= 0{\cdot}434 \times H \times S$ pounds per square inch.

In practice an increase of from 10 to 15% will be found necessary. Excessive air pressure should be avoided on account of the possibility of the air escaping, at the conclusion of the work, at a pressure considerably above that of the surrounding atmosphere.

**Air Volume.**—The volume of air required per unit volume of fluid to be lifted is proportional to the height of lift. In Prof. Jossé's tests the highest efficiency, 44·9% of the work indicated in the compressor cylinder, was obtained, in the case of a lift of 24·6 ft., by the use of compressed air at equivalent atmospheric volume $1\frac{3}{4}$ times the volume of water lifted.

Kelly's results, at Preesall, show that the highest efficiency obtained in a single lift system was in the case of a 113-ft. lift, and with the use of an equivalent free air volume to water in the ratio of 4·5 to 1.

At the East Rand plant maximum efficiency was obtained in a lift of 43 ft. with a volume ratio of equivalent free air to thin slime-pulp (sp. gr. 1·1) in the ratio of 2·418 to 1.

The altitude of the East Rand plant above sea level would have considerable effect on air-compressing operations. It has been shown that gauge-pressure necessary to work an air-lift is dependent on the depth of submergence, and the specific gravity of the pulp. The required pressure is, therefore, independent of altitude. The expansion of the air is a potent factor in the working of the lift; and, since exhaust, under normal conditions, is at atmospheric pressure, it follows that air-lifting is as economical at altitude as at sea level; an extra cost for compression being balanced by an increased expansibility of the air when compressed.

E. A. Rix[4] gives the following ratios for various lifts:

| Height of lift. | Volume of free air. | Volume of water. |
|---|---|---|
| 20 ft. | 1·5 to 2·0 cub. ft. | 1 cub. foot |
| 20 to 50 ,, | 2·0 to 3·0 ,, | 1 ,, |
| 50 to 100 ,, | 3·0 to 4·0 ,, | 1 ,, |

**Velocity of Flow.**—It is generally conceded that the velocity of the mixture in the rising main should be as low as possible. As a rough guide it may be taken that the area of the lift pipe in square inches should not be much less than one half of the number of cubic feet of pulp requiring to be lifted per minute. With pipes of constant diameter the velocity in the rising main increases from the base to the discharge; and, under normal conditions, the gradual expansion of the air is responsible for the doubling of the initial velocity. An increase of the area of the rising main to counteract this increase in velocity has been suggested. In ordinary cases this would be impracticable; but it would seem that, in the Pachuca agitator, a gradual increase in the diameter of the lift pipe would obviate an unnecessary discharge velocity, ensuring a better mixture of air and pulp, and allowing a quieter action at the top of the vat.

The Preesall installation of air-lifts handles nearly one million gallons per day; and, at the conclusion of his valuable contribution to the literature of the subject Mr. Kelly states: "Experience in the working of these air-lifts has amply justified the installation of the system, since the extra cost for fuel is nearly balanced by the saving in maintenance costs alone, leaving out of account the saving due to freedom from stoppages, and the interest on the cost of extra plant which would have been needed had the system of lift pumps been extended to meet present and future requirements."

In lifting fluids by any system an increase in specific gravity, within normal limits, is followed by a corresponding increase in power consumption. Maintenance costs in the case of plunger or centrifugal pumps, pumping fine ore in suspension, are by no means insignificant. Hence economies shown to be effected by the substitution of air-lifts for lift pumps in the elevation of water are likely to be still further realized in the elevation of slime pulp.

[4] Trans. Tech. Soc. of the Pacific Coast, 1898.

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**The Carnegie Gold Medal.**—The Council of the Iron and Steel Institute have awarded the Carnegie Gold Medal to Dr. Paul Goerens, of Aachen. Dr. Goerens is a member of the staff of the Royal Technical College at that city. He has made many contributions to scientific metallurgy, and in 1910 he was awarded one of the Carnegie Scholarships of the Iron and Steel Institute, to enable him to pursue his investigations on the 'Influence of Cold-working on the Properties of Iron and Steel.' The Gold Medal is now awarded to him in recognition of the highly meritorious character of his research work on this subject.

# DISCUSSION

Our readers are invited to criticize anything appearing in this magazine and to discuss other subjects of general technical interest.

## Basic Lining.

The Editor:

Sir—In Mr. W. G. Perkins' comments in the February issue on your editorial in the December number on basic lining for copper converters, the statement is made "that a converter half the size of the large acid-lined converters will work successfully and economically as a basic-lined converter." Has this ever been done? At the works where basic lining was first successfully applied, acid lining is still employed for small quantities and high-grade matte. The converter in which copper was first made with basic lining was about the size of the largest acid-lined converters then used. As previous unsuccessful attempts had been made by such skilled metallurgists as Keller, Hixon, and Raht, but with small converters and high-grade matte, I think the conclusions of your editorial are amply justified.

Mr. Perkins' view is that improvements in the design and construction of converters as applied by Smith and Peirce have made the basic-lined converter a success. Insomuch as the basic-lined converter was a complete success before they started their experiments and hundreds of tons of copper were made with it I cannot accept this view. The introduction of basic converting in many works is due to the energy, business ability, and financial backing of Smith and Peirce, and for this all interested in the process give them credit. To admit that slight changes in methods of relining, tilting, etc., entitle them to the credit due to skilful work by many trained metallurgists is dangerous. In the study of a chemical problem not much attention is paid to the motions of the stirring rod or the shape of the beaker. So far no one who has invented any change in the miner's drill has claimed the success of all mining. As pointed out by your correspondent the main difficulties in basic-lined converting are the grade of the matte and the regulation of temperature. When the hole-in-the-wall system of heating rooms was succeeded by the less beautiful but more efficient stove, doubtless great difficulty was experienced from overheating until knowledge of the regulation of the draught was acquired. In converting, the lower the grade of matte the greater the amount of heat that will be evolved, but this can be regulated by the amount of blast. It is a difficult thing to regulate and much depends on the skill of the operator. Doubtless before long some form of pyrometer will be devised to indicate readily the temperature in a converter. In the Pittsmont smelter in Butte in 1905 mattes of as low grade as 10% Cu were converted without over-heating or destruction of the lining. In all converting operations the skill of the operator has been a most important factor. The largest acid-lined converter plant ever built was an unsuccessful muddle for months until the right man was found to operate it. In all operations requiring technical skill the demand has created the supply, and with basic-lined converting the experience will undoubtedly be the same.

Regarding the question of flux, one of the great advantages of the basic-lined converter is that any silicious material may be used, while in the acid-lined converter the range is limited. When copper was first successfully made in a basic-lined converter the converting was merely an adjunct to the Baggaley process for smelting ores in a converter. The ore used as flux was second-class Butte ore having the following composition: $SiO_2$ 52%, Fe 14%, S 17%, $Al_2O_3$ 7·5%, Cu 3·5%. Of course, if ores are used instead of quartz, a larger quantity of converter slag will be made. This is an important point and is related to the question as to what grade of matte it is most profitable to make in the furnace. The lower the grade of matte produced in the furnace the lower will be the furnace slag loss, but if this low-grade matte is treated in the converter, the greater will be the quantity of converter slag to be re-treated; also the lower the silica content of the flux used in the converter with any grade of matte the greater will be the quantity of converter slag produced. In basic-lined converting in Butte the slags produced contained over 1% copper, the silica ranged from 12% to 30%, and the FeO from 62% to 75%. As these slags were too rich in copper to be thrown away, they were poured while still liquid into the top of the blast-furnace, becoming thus treated practically without cost. In considering what grade of matte the furnace is to produce and what should be the nature of the flux from the basic converter, an important question to consider is the treatment of the resulting converter slag. If it is thrown away a serious loss of copper occurs. It can be treated at low cost in a reverberatory furnace with other materials or at practically no cost by pouring into the top of the blast-furnace. If cooled and re-smelted it takes about 10% of coke for such re-smelting.

The basic-lined converter is showing its

superiority for large quantities of matte and the possibility of converting even the lowest-grade matte. For converting small quantities of high-grade matte there is no record known to the writer of the successful employment of the basic lining.

W. A. HEYWOOD.

London, March 20.

### The Finance of a Mine.

The Editor:

Sir—Mr. Burnham covers a lot of ground in his series of articles entitled 'The Finance of a Mine,' and finally, and perhaps unconsciously, shows as the outcome of his investigations, that it is a brave man that will ever face the risks of mining regarded purely from the investment standpoint.

The principles of amortization of capital and compound interest, risk-rates and discount, he applies to what in the mining world are regarded as first-class mines, and conclusively shows that they do not satisfy the requirement of these factors when their figures are put to the test.

I do not think that in a general sense anyone will quarrel with Mr. Burnham's figures or statements in regard to risk-rates or estimated shoot-extensions, although one might hold opinions at variance in detail, such as in the method of arriving at block valuations, or the weight of assay results, but the broad principles may, for my part at least, be accepted. In fact, I go further and follow with Mr. Burnham right up to his inevitable conclusion tersely expressed on page 280, namely:

(*A*) The rate, etc.

(*B*) Any investment, etc.

It is my belief, however, that neither Mr. Burnham nor any other engineer or financier is likely to continue in the mining business long if he persists in the demand for these stipulations. And why? Because mining is not a banking business, and it cannot respond to a criticism based on banking lines. Its average risk-rate is undoubtedly high, and the only reason that people put their money into it is because they are lured on by the extraordinary success of a certain percentage of mining ventures. They don't expect banking profits either; they are looking for profits of tens where in banking business they would expect units, and it is in this that the essential difference lies.

If all orebodies were homogenous in constitution and absolutely unvarying in width and value; if they could be examined and appraised without first spending large sums of money on them; and if there were not fluctuations in the selling price of metals; then with trifling adjustments from time to time to cover improvements in metallurgy and mechanics and in methods generally, the principles of banking could be applied. But all orebodies are notoriously variable in width, value, and constitution, and, depending upon the degree of this variation, so do the principles laid down by Mr. Burnham become more or less applicable.

In any case, the man who starts mining in a new camp must begin with an enormous risk-rate. In fact it could only be expressed to begin with as 100%, and who is going to start on such a scheme from a purely investment standpoint? Therefore at the outset we may state it as an axiom that money launched in the investigation of a new mining district is not put there as an investment. It is spent purely as a speculation.

It would, however, be quite wrong even in a new district to class a virgin prospect with a partly developed mine, as in one case, surface indications are the sole guide to the estimation of value, while in the other case, a great many of the actual foundations governing the mineral deposit have been disclosed and are known.

The outlay of money in this latter case, whilst less speculative than in the first named, still must remain in the category of the very speculative. Expressed as a risk-rate it might, for the sake of argument, be taken at 90% as against 100% in the first case. Money provided for the further development and exploitation of a partly developed mine in a new district, is some degree less speculative than where no development at all has been done. Again we proceed a step farther and take, still in a new district, a well developed mine with say 200,000 tons of ore blocked out, estimated to have a profit value of 20s. per ton. In this case the original subscribers took the 100% risk-rate and their speculation has arrived at the stage where the risk has been considerably reduced. If there had been no appreciation in the price of the shares of the company, the speculator coming in at that stage would be very much favoured as compared with the original speculator, who not only took a 100% risk, but whose capital in the meantime has been unproductive even of interest. As a rule, however, if development is proceeding satisfactorily, the shares of the company are run to a premium, such as would more or less discount all the favourable results of development, thus leaving the risk-

rate pretty well where it was. This argument applies to mines in every stage of development or production, and we may conclude that the price of shares will always include a reasonable discount of the possibilities of the future, and this discount may be taken to represent or to correspond to the risk included in the purchase.

In view of the vagaries of orebodies in their width, and of shoots in their length and depth, and taking into consideration, where such obtains, the fluctuation of the metal contents, no sane person can regard any statement of ore reserve, either in regard to tonnage or content as being really accurate, and his dependence on the statements made must be gauged by his confidence in the character of those who make the statements; in other words there is a personal equation in regard to all of these statements that undoubtedly has the greatest bearing upon their intrinsic value.

So far as the public is concerned, it would seem wise to follow the reputable engineer, because he is at least jealous of his reputation, and is not likely to be very optimistic without good ground. It is the so-called engineer who is responsible for so many of the unscrupulous tricks and bare-faced swindles that have marked the development of the mining industry, and unfortunately, he is still in evidence in present day operations. He holds out such wonderful prospects to the innocent layman, that from a company-promotion standpoint he is much more successful than the conscientious engineer. In fact there is no limit to the extravagance of his statements, and as the layman generally uses his own discrimination he is naturally more inclined to follow the most alluring one, and it remains an indisputable fact that the financing of a large proportion of new mining ventures is carried out on the strength of such statements.

As between Mr. Burnham's scientific suggestions and actual practice, what a difference, what a gap, is there. When even the most elementary considerations are often ignored in a public transaction involving hundreds of thousands of pounds, how can we expect in one step to reach the slightest appreciation of the refinements of calculations, such as those to which reference is made? The risk-rate therefore to be comprehensive must take some note of the reputation of the man who is responsible for the calculation of the future prospects of a mine.

The absolute value of a mine is never known until worked out, and between this stage and that of the same mine when it was a prospect, will occur all the varying conditions that go to the making of the different risk-rates. Where some prospects would begin with a risk-rate of 100%, there are others which might be estimated at only 20%, depending upon the amount of capital involved as compared with the amount of profit in sight. The degree of accuracy possible in the estimation of the value of any developed orebody will vary with the homogeneity of that body.

For instance, a low-grade narrow orebody, carrying irregularly distributed pockets of high-grade ore, is not susceptible of an estimate beyond the merest approximation, while a wide body, with an even dissemination of the valuable content, lends itself to reasonably accurate assessment.

In new districts, costs are always comparatively high, and consequently, to begin with, the grade of ore handled must also be high to show any profit. A good illustration of this is found in the returns of the Witwatersrand companies during the past twenty years. To begin with, only the richer sections could be worked at a profit, and the residues of many of the mines were in the early days higher in value than many sections of low-grade ore included today in computations of ore reserve.

The condition therefore is a constantly changing one from either the investment or speculative point of view, and, in mining, these changes are apt to take place, either so suddenly that there is no time to take advantage of the change from the investment point of view, or so gradually that the real nature of the change is obscured.

A small quantity of very high-grade ore may return a big profit, despite the fact that the working cost would be high. But in most mines the percentage of such ore is limited, and attention has sooner or later to be turned to lower grades, when in order to maintain the profit the tonnage crushed has to be increased accordingly. To do this, fresh outlay on capital account is demanded and generally this is marked by re-organization of the company. In a few notable cases this may be done out of profits without re-organization, but not often. In any case the conditions have quite changed, so that from either the speculative or the investment platform, the position must be considered *de novo*.

In fact, it may truthfully be said, that in the history of almost every mine there are

records of great changes, and in remarkably few cases have there been accurate forecasts of what those changes were to be. The percentage of mines that live up to the estimates made regarding their profit-earning capacity is practically nil. The percentage that exceed the estimate is small. The percentage that fail utterly in the attempt is lamentably large. The most careful estimate is at least only an approximation that may be good for a limited time, but even such an estimate requires constant revision and amendment. In the opening up of a mine it must not be forgotten that the tendency always is to start all new development work at high-grade points. On the original valuation by the orthodox averaging system, there is great danger that an undue proportion of high-grade ore will be included in the computation, thereby artificially inflating the value and wrongly reflecting the probable profit in sight.

Mr. Burnham has not quite overlooked this point, and he would reply that his 'standard block' is designed to meet the difficulty. Once the mine has considerable area under development and consequently once the mine has been capitalized to the extent necessary to disclose all the data essential to the computation advocated by Mr. Burnham, then I grant that the application of his principles will unquestionably tend to a more accurate determination of each of those factors included in the general scheme of a sound valuation. The main trouble, however, is to first find the capital to cover the prime speculative risk, and once having accomplished that much, the more academic refinements of what may be the precise value of the venture from an investment standpoint may be more deliberately and certainly more complacently studied.

As elsewhere stated, the real value of a mine can never be known until it has been worked out. It is idle, therefore, to apply the principles of banking to an industry that cannot offer the elements which those principles call for. The man who insists upon an investment which will satisfy his bankers on the score of present values, replacement of capital, and interest on the investment, cannot expect at the same time to have the chance of replacing his capital tenfold in a limited period. The two things are inconsistent and few well advised people go into mining merely to get bank rates of interest. Their hope of profit is expressed in the risk-rate they are prepared to face and the speculator who has the good fortune to draw a good mine, as the result of his initial risk, deserves the reward of his enterprise, but his operations do not come into the category of investments. I may go further and say that it was not until I had studied Mr. Burnham's articles closely that I was definitely able to accept the fact that the mining business cannot be asked to stand for the very principles he states, and it is in this sense that his work to my mind possesses the greatest value. I think it a good thing to endeavour to apply his tests to every case that comes forward, because although a mining investment may never be found to satisfy his demands, some cases will come closer than others, and the nearer the approach the less risk there will undoubtedly be. This does not preclude the possibility, however, that a mine which at one stage fails utterly to respond to the test may ultimately and at no very remote period prove to be a much better mine than others which at the same stage gave much greater promise.

Other conditions being equal, the safest mining will always be where the orebodies are wide and continuous, and uniform in mineral content. Mines like the Homestake in South Dakota, where only a low grade is asked for because the cost of production has been reduced to a correspondingly low figure, are the sure profit earners. When ore selection has to be followed, everything is more precarious, seeing that both cost and production depend upon the hazard of the percentage of the selected ore. On every such mine the engineer will sooner or later be faced with the problem of handling standing blocks of ore that may be regarded as legacies from past development, and I hold the opinion that, if this problem were grappled with before a ruinously expensive policy of wasteful selection had exhausted all the better-class ore, there would be fewer sleepless nights for the engineers and financiers. Cost of production has a way of bending to 'force majeur,' but not before, and things are apt to go too easily while there is a big margin between revenue and expenditure. I believe that a much greater ultimate profit and a far less precarious existence are enjoyed by the mine that solves the economic question of taking the ore as it comes in the early stages of its history. The waste of time and money involved in a selective process with its high cost for development is not as keenly appreciated as it deserves to be. The specious arguments on present value theories advanced in its favour will not hold water when it comes down to the practical aspects of the question.

Mr. Burnham has taken a great deal of

trouble and has exercised much praiseworthy skill in presenting to us a statement of some of the things that must be done before we can postulate the financial standing of a mine, and I submit again that the inevitable conclusion to his investigation is that the accurate valuation of the mine is an impossibility. The amount of data that is involved in the calculation could never be up-to-date, excepting for a mine that is doing no mining and no development, for the reason that the position would have changed in the mine before the computation could be concluded, and even if it were not so, the computation may still for many reasons be framed upon an entirely wrong basis.

Nevertheless the engineer is forced to make valuations for the purpose of the financier, and it would be a great pleasure to find the reports drawn up on the lines suggested by Mr. Burnham, as the attempt to meet his conditions would doubtless bring about the compilation of much useful data that is in most reports conspicuous by its absence. Loosely drawn statements mixed with a mass of optimistic generalities are unfortunately characteristic of the orthodox report, and the financier or the layman is unfortunately much more easily moved by this class of report than by the carefully drawn and more conservative statements of the conscientious man.

No effort should be spared by the legitimate engineer to thoroughly sound the commercial value of his technical investigation by applying the most drastic tests, but he may take it for granted that unless he has the courage to back his own experience and judgment as an offset to the risk-rates which he must face, he will wait through long intervals between business. The nearer he can get to realizing the ideal conditions of a Consol investment, the smaller will be his risk, but there will in most cases be a corresponding prospective lack of big profit and quick achievement in the undertaking. Mining always has and always will be a speculative business, and the big risks will only be taken by the men who are prepared to gamble on the result.

The best safeguard of the financier lies in the skill, ability, and integrity of his technical adviser, and I agree cordially with Mr. Burnham that it is the duty of the engineer to thoroughly understand the practical financial considerations involved in his technical conclusions before he finally sums up his recommendations.

The growing tendency to place the engineer on the directorate of mining companies is undoubtedly sound, and I confidently look for a further development in this direction in the future. The effect of that policy must make for greater security and the percentage of failures in mining ventures is certain to be much lower where the policy is adopted.

In conclusion Mr. Burnham is to be congratulated on his work and I trust that he will forgive me for having used his conclusions for a purpose and to an end that was hardly contemplated by him.

H. S. DENNY.

City of Mexico, February 29, 1912.

## Foreign Mining Enterprise in China.

The Editor:

Sir—As doubtless many of your readers are aware, at the termination of the Boxer troubles in China, a treaty was concluded between Great Britain and China referring to various commercial matters and entitled 'The British Commercial Treaty with China,' and signed on September 7, 1901.

Article IX of this treaty deals with the development of the mineral resources of China and reads as follows: "The Chinese Government, recognizing that it is advantageous to develop its mineral resources, and that it is desirable to attract foreign as well as Chinese capital to embark in mining enterprises, agrees within one year from the signing of this Treaty to initiate and conclude the revision of the existing Mining Regulations. China will, with all expedition and earnestness, go into the whole question of mining rules, and selecting from the rules of Great Britain, India, and other countries regulations which seem applicable to the condition of China, she will recast her present mining rules in such a way as, while promoting the interests of Chinese subjects and not injuring in any way the sovereign rights of China, shall offer no impediment to the attraction of foreign capital or place foreign capitalists at a greater disadvantage than they would be under generally accepted foreign regulations. Any mining concession granted after the publication of these new rules shall be subject to their provisions."

A copy of this treaty is given as an appendix to Putnam Weale's book 'The Truce in the East,' as well as in several other publications.

Shortly after this treaty was concluded, Mr. Wallace Broad was appointed by the Chinese Government to draw up a set of proper regulations, in accordance with the above-quoted article. These regulations were then, for some considerable time, sent from Viceroy to Viceroy, each of whom remodelled them according

to his particular views, with a result that, so far as the writer knows, no mining regulations which "shall offer no impediment to the attraction of foreign capital" were ever put into force. The whole question has been allowed to drift into obscurity.

It is the opinion of many mining engineers, an opinion which the writer strongly holds, that the opening of Chinese mining to foreign capital and the enactment of a progressive and liberal set of mining regulations will be followed by an era of great mining activity in China, as advantageous to the Chinese as to foreigners. The old conservative and backward policy which has for so long retarded the progress of this great country seems now to be nearing its end, and all indications point to the introduction of a much more progressive rule and the development of China in accordance with modern ideas. Doubtless this change will also include a new Mining Law. Now that there is a change of Government in China, this would seem to be an appropriate time to raise the whole question of mining rights in that country, particularly should the newly formed Republic be seeking recognition from the Powers.

This letter has been written with the hope that *The Mining Magazine* may see fit to support these views and use its influence to have the matter brought to the notice of those in authority, so that at least what has already been granted may be made into something more than an empty treaty and possibly secure more advantageous terms and such guarantees of security of mining title that will warrant the introduction of foreign capital into China to the benefit of all concerned and especially to the mining profession.

A. R. WEIGALL.

Sydney, January 26, 1912.

## Breaking Ground.

The Editor:

Sir—I have read with interest the remarks of Mr. R. Allen quoted in the Johannesburg letter in your last issue, and can confirm what he says regarding the use of hard-wood tamping rods to get the explosive to the bottom of the hole, and so expel the air, which, if allowed to remain, would act as a cushion and interfere with the duty of the explosive. A working miner named Thomas Moor, employed in the Carn Brea mine, was probably the first Cornish miner to know how to use dynamite, and he, by adopting the principle mentioned by Mr. Allen, earned 25% more wages on contract than his fellow workmen. He used a copper tamping-rod, but I should say that one of proper hard-wood would be preferable.

It will not be out of place here for me to give you my experience when dynamite was first introduced into Cornwall. At Tincroft we obtained a record speed in one of the hardest tin capel lodes in the country, by 12 men working 6-hour shifts, each shift relieving the other in place. The holes were drilled by hand labour, and every hole was purposely blasted twice; that is to say, one or two sticks of dynamite were first blasted to chamber the bottom before the second charge was entered.

I also found that gunpowder would follow dynamite with results equally as good as when dynamite followed gunpowder. That is to say, if a hole was blasted with gunpowder, which is much slower in its action, and the ground did not break completely, a big rent or crack would be the result, which would allow the subsequent explosion of a dynamite charge to be most satisfactory. Similarly if a first charge of dynamite did not bring away its burden, the result would be a hole largely chambered at the bottom. If then into this a charge of gunpowder was put and rammed to the bottom, the result, after blasting, would also be most satisfactory.

W. TEAGUE.

Falmouth, March 25, 1912.

## Royal School of Mines.

The Editor:

Sir—I note in the personal column of your January issue a statement that the instructor in assaying at the Royal School of Mines has been raised to the rank of professor. This step will certainly be received with approval by all interested in the Royal School of Mines. It shows that attention is now being devoted to the personnel of the staff as well as to the buildings and equipment. Much has been done lately to improve the latter, but the matter of greatest consequence must always be the efficiency of its teaching staff. The splendid past records of the School prove this. It is also a common experience that the sayings of a friend and teacher remain vivid when laboratory experiments are forgotten.

Of many graduates, not the least brilliant are those who subsequently join the staff. Amongst these are many to whom their work is in the nature of a religion and who consequently evince some indifference to commercial matters. It may be in order to test this spirit that the governing body has always made the relation between worth and wage so disproportionate. As however the principle

of letting virtue be its own reward must often mean great hardship to the assistant staff, it is to be hoped from the appointment referred to that steps are now being taken to arrange the status of this staff upon more equitable lines.

MUNGO PARK.

Federated Malay States,
February 12, 1912.

## Concentration v. Cyanidation.

The Editor:

Sir—Under the above heading, I contributed a note to your magazine of December last, with the express intention of raising discussion on the subject. Mr. A. W. Allen is, so far as I am at present aware, the only contributor to the discussion, and I have pleasure in answering some of his queries, and in traversing some of his views.

Mr. Allen says at the outset, "I cannot see why the loss in treatment of 5% of the assay-value should be deducted from the actual contents, and at the same time appear in the cost of production of the concentrate." He then goes on to show how he would state the case, in what he describes as a simpler form, in which he eliminates from the statement of cost the losses of metal made in the treatment.

I differ so much in this regard from Mr. Allen as to think that any other item of the cost might just as well be ignored, when calculating the total charges upon the silver actually returned, as that of the loss. As a matter of fact in cases of poor extraction, the loss in treatment is the most important item of cost in the whole of the operations. My attitude in the matter is best explained if we assume that I am a producer of silver and that all my cost accounts are kept in terms of ounces of silver. I have ores which contain a certain quantity of silver per ton. If it were possible I would employ processes that would return me 100% of the content at no cost to myself. Unfortunately it is not possible to recover all the silver from the ores, nor to work the various processes without cost. The metallurgists therefore to whom I deliver my ore, treat it and return to me a certain residual weight of silver, telling me that is all there is left after deducting: (*1*) a weight of silver corresponding to the cost of the operations, and (*2*) a weight of silver which through loss due to the imperfections of the metallurgical processes is not returned to me.

To illustrate the liquidation sheet I should receive from the metallurgists, let us take the figures given in my December note, relating to value of concentrate and cost of production, which are as under:

| | | | |
|---|---|---|---|
| Assay-value of concentrate, 1200 oz. per ton, or £120: | | | |
| Cost to produce 1 ton of concentrate..... | £10 | 0 | 0 |
| Freight and treatment charges on 1 ton concentrate ..... | 2 | 2 | 0 |
| Loss in treatment (smelter deduction) ..... | 6 | 0 | 0 |
| | £18 | 2 | 0 |

Substituting for the above amounts the equivalent in ounces of silver, calculated at 2s. per oz., the liquidation sheet from the metallurgists would read as under:

| | | | |
|---|---|---|---|
| Assay-value of concentrate, 1200 oz. silver per ton | | | |
| Ounces of silver deducted to cover the cost of producting 1 ton of concentrate ..... | 100 | | |
| Do. do. do. freight and smelting charges ..... | 21 | | |
| Do. do. do. losses in smelting... | 60 | | |
| Total ounces deducted ..... | 181 | | |
| Balance of silver delivered to me by metallurgists, 1200–181 ..... | 1019 | | |
| Original money value of concentrate 1200 × 2s. ..... | £120 | 0 | 0 |
| Money value of silver returned to me 1019 × 2s. ..... | 110 | 18 | 0 |
| Money value of silver deductions made by metallurgists..... | £18 | 2 | 0 |
| Cost per oz. of silver returned to me ..... | 4·26d. | | |
| (This was erroneously put in my December note as 3·83d.) | | | |
| Percentage of total silver returned to me, after deducting all charges..... .... | 85 | | |

If now we take the same figures, excepting for the treatment loss which we will take to be 30% instead of 5%, it will be seen why I regard the loss in the metallurgical operations as the most important item of cost.

| | | | |
|---|---|---|---|
| Assay-value of concentrate 1200 oz. | | | |
| Ounces of silver deducted to cover the cost of producing 1 ton of concentrate ..... | 100 | | |
| Ounces of silver deducted to cover freight and smelter charges..... | 21 | | |
| Ounces of silver deducted to cover losses in smelting..... | 360 | | |
| Total ounces of silver deducted ..... | 481 | | |
| Balance of silver delivered to me by metallurgists, 1200–481 ..... | 719 | | |
| Original value of concentrate 1200 × 2s. .. | £120 | 0 | 0 |
| Money value of silver returned to me 719 × 2s. ..... | 71 | 18 | 0 |
| Money value of silver deducted by metallurgists ..... | 48 | 2 | 0 |
| Cost per oz. of silver returned ..... | 16d. | | |
| Cost per oz. of silver returned for metallurgical losses only ..... | 10·3d | | |
| Percentage of total silver returned to me, after deducting all charges ..... | 60 | | |

I think that Mr. Allen will admit that when my return of silver, after deducting all charges

made by the metallurgists, drops from 85% of the original content to 60%, owing to the increase in the metallurgical losses, it is of material importance to express those losses in the cost of production, as I showed in my December note, and further I think he will admit that his "clearer and more correct manner" of presenting the statement leaves out of account the most important item of cost. As a matter of fact, Mr. Allen's mistake in this connection is a very general one, and it is obviously due to the habit of considering assay-values in terms of metal, and the cost of production in terms of money. If we transpose Mr. Allen's statement on the "Realization of values in 1 ton of Concentrate" into monetary terms throughout, the position is at once made clear, namely:

| | | | |
|---|---|---|---|
| Production costs | £10 | 0 | 0 |
| Freight and smelter treatment | 2 | 2 | 0 |
| Total cost | £12 | 2 | 0 |
| Assay value (1200 oz.) | £120 | 0 | 0 |
| Treatment loss 5% (60 oz.) | 6 | 0 | 0 |
| Total value of silver recovered | £114 | 0 | 0 |
| Deduct cost of production | 12 | 2 | 0 |
| Net result of operations, after deducting all charges | £101 | 18 | 0 |
| Net result of operations, after deducting all charges, expressed in terms of silver (which is the same figure as shown above in my calculations) | 1019 oz. | | |

I cannot follow Mr. Allen's arguments regarding the refining cost. My statement is perfectly clear, namely, that the refining charge equals 0·8 pence per oz. of bullion, and an ore which yields 30 oz. fine silver per ton returns 33·3 oz. of 900 fine bullion, making the refining change 0·89 pence per fine ounce. Mr. Allen says, "Refining costs are paid, not on the original amount of metal in the ore, but on the amount recovered. Hence on the basis of 0·89 pence per fine oz., the refining cost per ton is 2s., and not 2s. 3d. as stated." It will be seen that I make no reference to the original assay-value, but to the yield and bullion. Mr. Allen has evidently confused 'yield' with original assay-value, and therefore draws a wrong deduction from my statements.

Mr. Allen now goes on to make calculations, based on my original figures, to show the relative merits of:

(1) Concentration and subsequent cyanidation of the tailing from the concentrating plant.

(2) Cyanidation of the whole material without previous concentration.

In dealing with the concentrate he repeats his error that the loss in treatment is not to be shown as a charge against production, an error with which I have already dealt. In dealing with the cyanidation of the tailing he allows an extraction of only 88%. There is however no reason why, from tailing of an ore of the character under discussion, deprived through concentration of rebellious elements, an extraction of over 95% should not be obtained, and certainly not less than 94%, in modern practice. As in dealing both with concentrate and tailing, Mr. Allen, according to my view, has committed grave errors, I propose to submit a corrected calculation giving the results that would be derived from the combined concentrating and cyaniding processes, and referring, as Mr. Allen has done, to a lot of 200 tons.

| | |
|---|---|
| 200 tons of ore containing | 6000 oz. |
| 1 ton of concentrate produced containing | 1200 „ |
| Assuming no mechanical loss, tailing contains | 4800 oz. |

Yield from the Concentrate: In previous paragraphs, it has been shown that the net silver yielded by the concentrate, after deducting all charges, is 1019 oz., at a cost of 4·26 pence per oz., the net yield representing 85% of the total original silver contained.

Yield from the tailing:

| | oz. | | |
|---|---|---|---|
| Total content of 199 tons of tailing | 4800 | | |
| Silver deduction representing cyaniding cost at 4s. 6d. per ton, 199 × 2·25 oz. | 448 | | |
| Silver deduction representing cost refining 5013 oz., 900 fine | 186 | | |
| Silver deduction representing metallurgical losses (94% extraction) | 288 | | |
| Total deductions | 922 | | |
| Balance of silver delivered by metallurgists 4800–922 | 3878 | | |
| Original money value of tailing 4800 × 2s. | £480 | 0 | 0 |
| Value returned 3878 × 2s. | 387 | 16 | 0 |
| Money value of deduction made by metallurgists | £92 | 4 | 0 |
| Cost per oz. of silver returned | 5·7d. | | |
| Percentage of total silver returned by metallurgists, after deducting all charges | 80·06 | | |
| Result of combined processes: | | | |
| Total silver returned by metallurgists 4897 oz., costing 1103 oz., or | £110 | 6 | 0 |
| Cost per oz. of silver returned | 5·4d. | | |
| Percentage of total silver returned, after deducting all charges | 81 | | |

The foregoing figures, it will be seen, are radically different from those arrived at by Mr. Allen, who shows that the combined processes yield 5364 oz. of fine silver at a cost of

the equivalent of only 725 oz. of silver; that is to say, by his figures the yield, although taken at only 88% for the cyanide process where I take 94%, is 467 oz. higher and the cost 378 oz. less, or a total of 845 ozs. to the good, compared with my method of figuring. Also he calculates the cost per oz. of silver as at 3·25 pence, whilst I make it 5·4 pence.

Mr. Allen next calculates the result of the treatment of the 200-ton lot by cyanidation without concentration, using, as he says, my figures. It is surprising to note that Mr. Allen has entirely overlooked the fact that in treating the ore without previously extracting a portion of the silver by concentration, there are certain proportionately increased charges to be reckoned with. The consumption of cyanide alone would show a considerable increase, not only because there is a great weight of silver to dissolve, but also because there would be much more decomposition of the cyanide solution by the rebellious elements constituting the minerals which form the great bulk of the concentrate. There would also be increased cost in zinc and chemicals generally, and in the collection and melting of the precipitate. Totalling all these items, it would add at least another eightpence per ton to the cost of cyanidation, making it 5s. 2d. instead of 4s. 6d., which was my figure for a lower-grade ore.

Again, it is a matter of common experience that the minerals which largely make up the concentrate, even in an ore of the type we are considering, are not readily amenable to cyanide treatment. Given extremely fine division—perhaps 500 mesh—very strong solutions, and a protracted period of treatment, comparatively high extraction might be obtained, but at the cost of increased capital cost for plant, higher working cost, and an excessive consumption of cyanide. The time allowed for the treatment of the mixed material—looking upon the charge as a mixture of tailing and concentrate—is sufficient for the tailing, but too short for the concentrate. Consequently we must regard the charge from the point of view of its amenability to cyanidation under the usual conditions of treatment.

From the tailing we may expect to obtain an extraction of 94% at least in modern practice. From the concentrate, it is not probable that the extraction will exceed 70% on the average, in the time, and with the strength of solution ordinarily used; therefore in the case we are using where the tailing contains 80% of the value and the concentrate 20%, the total extraction from the mixed charge would be just under 90%. On these bases, therefore, we can calculate the results to be obtained from the direct cyanidation of the ore:

200 tons of ore, containing 6000 oz. of silver, 4800 oz. of which are contained in the portion we designate for this purpose as tailing, and 1200 oz. of which are contained in the concentrate.

| | oz. | | |
|---|---|---|---|
| Silver extracted, 94% of 4800 oz. in the tailing | 4512 | | |
| Silver extracted, 70% of 1200 oz. in the concentrate | 840 | | |
| Total silver extracted | 5352 | | |
| Silver deduction representing cyaniding cost at 5s. 2d. per ton, 200 × 2·6 oz | 520 | | |
| Silver deduction representing cost of refining 5947 oz., 900 fine | 220 | | |
| Silver deduction representing metallurgical losses (6000–5352) | 648 | | |
| Total deduction | 1388 | | |
| Balance of silver delivered by metallurgists, 6000–1388 | 4612 | | |
| Original money value of ore, 6000 × 2s. | | £600 | 0 0 |
| Value returned, 4612 × 2s. | | 461 | 4 0 |
| Money value of deductions made by metallurgists | | £138 | 16 0 |
| Cost per oz. of silver returned | | 7·22d. | |
| Percentage of total silver returned by metallurgists, after deducting all charges | 76·8 | | |

This again is a very different result from that arrived at by Mr. Allen, as he shows 5400 oz. recovered, at a cost of the equivalent of 650 oz. of silver; that is to say, he shows 788 oz. more silver recovered and a cost of 738 oz. less, or an aggregate of 1526 oz. to the good, as compared with my figuring. Also he calculates the cost per oz. of silver returned as at 2·9 pence, whilst I make it 7·22 pence.

The summarized figures resulting from my calculations may be presented as under:

| | 1. | 2. | 3. |
|---|---|---|---|
| Concentration | 4·26d. | 85% | |
| Cyanidation of tailing | 5·7d. | 80·06% | |
| Concentration and cyanidation combined | 5·4d. | 81% | 4897 oz. |
| Cyanidation only | 7·22d. | 76·8% | 4612 oz. |

Col. 1. Cost per oz. of silver returned, all charges deducted.
Col. 2. Percentage of original silver content returned, all charges deducted.
Col. 3. Oz. of silver returned, after deducting all charges.

Mr. Allen concludes his contribution with the following caustic sentence: "Cyanide operations must be conducted either under great disadvantages or with consummate carelessness, in a case where money could be saved by the shipping of treatable concentrate to the

smelter." The figures in the foregoing summary are the best commentary on his conclusion. They show that in the conditions as here presented concentration should be practiced to the fullest possible extent, since by that means the cost per ounce of silver produced is far lower, and the percentage return of the original value of the ore, after deducting all charges, is far higher than can be attained by direct cyanidation. If it were possible to concentrate 40% of the value of the ore into one-half of one per cent., instead of 20%, then the silver returned from the concentrate, after deducting all charges, would be 90% of the original value and the cost per oz. of silver returned by the metallurgists only 2'69 pence. Such figures make direct cyanidation look poor indeed. It will interest Mr. Allen to know that two very important Pachuca reduction plants, originally equipped with concentrators, discarded them some year or more ago to treat the whole of the pulp by cyanidation. These same plants, however, under the same management and after a long attempt to prove concentration uneconomical, have reverted again to it.

Has it ever struck Mr. Allen to inquire why, if concentrate is more economically treated by cyanidation than by smelting, no cyanide plants are competing for this product against the smelter? Is not the reason the obvious one that competition is impossible, because either the cost is too high, or extraction too low, or both. That being so, does the mere mixing of the concentrate with a large proportion of silica alter the facts in the case? Or does Mr. Allen suppose that the dissemination of the rich concentrate through the mass of a charge in an ordinary treatment tank reacts favourably with regard to its behaviour under cyanide attack.

It is common practice in Mexico to separate out from the milling ore all that which has a value of say 5 kilograms of silver or upwards. Why? Because the smelting of ores of these values has been proved to be more profitable than cyanidation. In the case of the concentrate we have been considering, the value is not 5 kg., but 40, or about 4% of base bullion. No metallurgist thinks it good practice to grind down rich ore which can be picked out, to mix with the pulp for cyanidation. Why? Because he realizes that on such high-grade material he will not get a satisfactory extraction. How much more force must there be for the argument when the material has the value of the concentrate we are considering.

The discussion of this subject will have been for nought if it has not clearly established the necessity for reverting to first principles from time to time. In all metallurgical work the aim is to extract with the least possible loss the highest percentage of metal. But we must not confound, as Mr. Allen has done, metal values and money values, as though they were two different and separate counters, and so ignore a most material, in some cases the most material, part of the loss. We must squarely face the position, placing on the one side the total metal contained, and on the other, firstly the difference between what is contained and what we can recover, and secondly what in terms of metal it has cost to recover the amount of metal we now have.

The final gauge of the efficiency and economy of our methods must be the residual proportion of metal remaining after all costs and losses are deducted. The metallurgical extraction is one thing, the economical result another. This leads me to observe, what I have many times already had occasion to emphasize, that reports of metallurgical operations should not be presented, as they now invariably are, merely to state the percentage of metal recovered by the metallurgical processes, but they should show the final residual value clear of all charges and deductions whatsoever. On the Rand for instance, the average assay-value of the ore is today say 31s. per ton, and the residual tailing and slime account for say 4s. per ton. The report in such a case is that 87% extraction has been achieved. But the cost is not taken into account. It costs on the average say 5s. per ton to effect the extraction reported, therefore we have out of 31s. original value, 22s. residual value, or 71%, and not as it appears 87%. An extraction of 71% is the correct reflection of the efficiency of the operations, and is the only sure means of comparison between the results of one mine and another working in similar conditions, or between the results of various processes. Were this not so, the chlorination process, with practical extractions of 98%, would outshine all others on certain ores, whereas 60% extraction, gained at a low cost by the cyanide process, would probably leave a higher net gain than 98% achieved at the cost of employing the chlorination process.

I will at another time take up Mr. Allen's suggestions on the subject of arrangements of zinc precipitation plant.

G. A. DENNY.

City of Mexico, February 22, 1912.

# PRÉCIS OF TECHNOLOGY

**Ancient Mine-Workings in the Transvaal.**—The January *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper on ancient mine-workings in the Transvaal, by T. G. Trevor. The metals found at these workings are chiefly gold, tin, copper, and iron. The author considers the larger workings as belonging to an era long before the arrival of the modern native belonging to the Bantu race, as also all the workings, large or small, in connection with gold and tin, the Bantus being responsible for only small workings in copper and iron. These workings extend all through the northern districts of the Transvaal and as far south as the northern edge of the High Veld, that is to say, to about the latitude of Pretoria. They are plentiful in Zoutspansberg, Waterberg, north Rustenburg, and north Middelburg, and are found to a smaller extent in Lydenburg and Carolina. Such as are supposed to be found in Marico are more often caves and fissures in the dolomite, though a few Bantu workings have been proved. The most remarkable feature in connection with the ancient workings is that they have all been filled by waste rock and earth. Indication of their existence nowadays is the presence of lines or clumps of bush and trees growing much closer than in the surrounding country. On penetrating the thick growth, depressions, sometimes as deep as 40 ft., are found, surrounded with comparatively low embankments apparently of waste rock. On sinking through the filling it is invariably found that the workings have not collapsed or been flooded, but that they have been deliberately filled with dump material. In some cases the filling has been found to rest on stulls. The reason for this filling of the workings is a mystery, but Mr. Trevor supposes that it was the desire to disguise the existence of the mines or to prevent others from obtaining ready access. He does not consider that the filling was done by subsequent inhabitants of the land. As regards the dump material and the filling of the workings, it is noteworthy that no mineral of value has been left behind. So much so is this the case that it is impossible to tell by an inspection of the dump or filling what was the ore or metal worked.

No roads or ruins of houses have been found, nor is there ever any trace of a tailing heap. It is seldom that a slag pile is found, and those so far discovered are of small extent, containing only a few tons of material. In all the workings hard waterworn stones are found that have been evidently used as hammers for striking metal gads, and stone mullers up to 100 lb. weight have occasionally been found. The stones used as hammers are worn in the centre, and there are no signs that they have ever been mounted on handles. Metal gads have been found, those from the Rooiberg tin mines being the most interesting. These are made of iron and are 18 in. long.

Mr. Trevor proceeds to give accounts of specific cases where old workings have been explored or reopened. He mentions that this class of work is extremely difficult, as may be appreciated after reading his introductory description as quoted above. Of gold workings those at Honingkloof in Mapoch's Gronden,

and at Weltevreden near Waterval Onder are the only two which have been reopened, but neither has proved to contain anything profitable. At Pilgrim's Rest traces of ancient workings were reported to be found at the Theta mine when originally worked between the years 1870 and 1880. Other gold deposits, where the gold is associated with complex sulphides of copper, zinc, and lead, were worked by the ancients in the north Middelburg district. Similar complex ores were worked north of Pilgrim's Rest, and on Koedoes river in Zoutpansberg.

Of ancient copper workings, the Messina mine in the north of Zoutpansberg is by far the most important that has been reopened. This is too well known to be described now. The only other district where old copper mines have been found is the Palabora lying to the north of the Selati and Oliphant's rivers in the same province. Here, the Lulu workings have been extensively prospected, but so far with no encouragement to justify any large expenditure of money. As regards tin it is noteworthy that the now famous Rooiberg mines were discovered by reopening a group of ancient workings which had the appearance of insignificant pan-like hollows covering a large area. At Weynek, a lode dipping at 30° had been mined to 200 ft. and the pillars left behind have been found to be quite rich. At the Leeuwpoort mine, which is to be introduced to the public shortly, there are numerous ancient workings following pipes of ore.

Mr. Trevor also gives information regarding old iron mines in Zoutpansberg, where low-grade micaceous iron and banded hematite have been worked partly for metal and partly for pigments. He concludes by reviewing the evidence as to the races responsible for these operations, and considers that they were identical with those that worked the mines in Rhodesia at some period before the Christian era.

**Cyanidation at Pachuca.**—The *Transactions* of the Mexican Institute of Mining and Metallurgy, Vol. II, No. 6, contains an article by E. Girault on the new 'Purisima Grande' mill and cyanide plant erected to treat the silver ores from the Guadalupe and Fresnillo mines, Pachuca. The design is noteworthy, as no stamps are used, the ore going straight from the rock-breakers to chilean mills. These ores had been worked for many years previously, but owing to the presence of oxides of manganese and iron, the old patio process was far from efficient. By means of fine grinding and slime-agitation, however, an excellent extraction is obtained. The capacity of the plant is 100 tons per 24 hours. The ore contains 75% silica, 10% lime, and 7% iron. It is first passed through a 15 by 9 in. Blake crusher and sent direct to five chilean mills of the Krupp type. Each mill has two runners, each 1½ metres in diameter and weighing when new 4080 kilograms. The new tires weigh 1660 kilograms each. Each mill can treat 24 tons per day of ore, 78% of which is greater than 5 cm. mesh and 22% less. The pulp as treated in the mills consists of 1 part of solid to 6 or 7 parts of solution containing 0·2% cyanide. Nine kilograms of lime is added per ton of ore. The power required is 15 to 20 hp. per mill, and the number of revolutions per minute is 18. The discharge is 10 cm. above the bottom, and the depth of the charge of pulp is 20 cm. An analysis of the discharge is as follows:

| | |
|---|---|
| On 100 mesh | 38·2 % |
| On 150 mesh | 9·5 „ |
| On 200 mesh | 5·1 „ |
| Through 200 mesh | 47·2 „ |

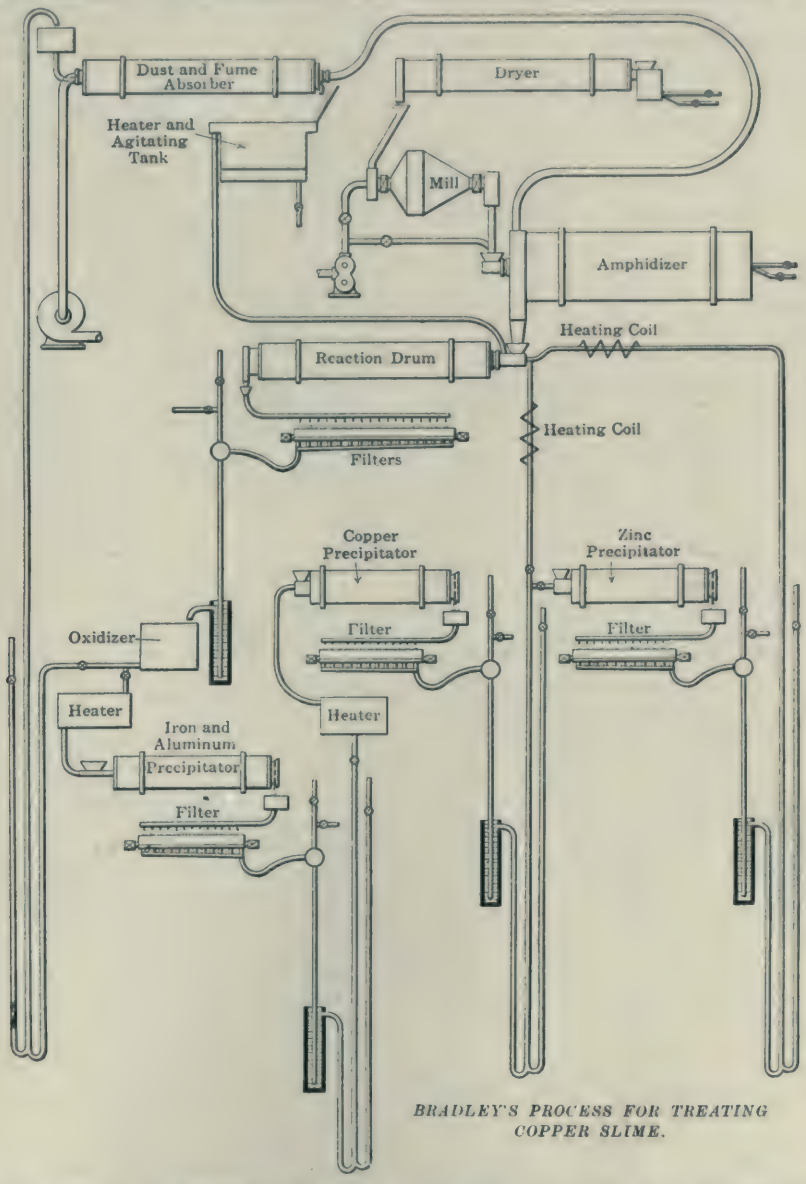
The tires and dies are of manganese steel. The tires last 6 months, by which time their weight has been reduced to 400 kg. The dies weigh 1500 kg., and after 3 months wear are reduced to 300 kg. weight. The consumption of iron is 1·054 kg. per ton of ore crushed.

The discharge from the chilean mills goes over Wilfleys, which recover 18% of the assay-value, contained in 0·5% of the weight of the ore. The tables also act as classifiers by removing some of the slime, which is sent direct to the thickeners. The remainder of the pulp is classified and the coarser sent to tube-mills. The total all-slimed material is treated in Pachuca vats and Moore filters.

**Atomized Zinc.**—*Metallurgical and Chemical Engineering* for March contains an account of a new atomizing apparatus intended for the production of zinc powder suitable as a substitute for the ordinary zinc dust used in precipitation of the precious metals from cyanide solutions. Zinc dust has some disadvantages, one being that it usually has a coating of oxide which introduces complications in the precipitation process, and another is that it is susceptible to further rapid oxidation and even violent combustion. It is claimed that the zinc powder produced by the atomizer has a bright surface and is not spontaneously oxidizable. Atomized lead may be produced by the same apparatus. The plant consists of a vertical cylindrical iron cylinder lined with fire-brick, and divided by a horizontal midriff into two chambers each heated by an oil-spray. The top chamber contains the crucible holding the metal, and the lower a coil for superheating a current of steam or air. The atomizing chamber is outside this cylinder. The jet of superheated steam or air impinges on the stream of metal issuing as a film, and blows it into a cloud of metallic dust which is subsequently collected in a settling chamber. The plant is simple and it is claimed that it is suitable for use at the metallurgical works, where the powder can be made from scrap or pig, according to requirements. Thus no transport of dust or powder is involved, and no opportunity is given for the powder to deteriorate between manufacture and use.

**Bradley's Process for Treating Copper Slime.**—The *Engineering and Mining Journal* for February 24 gives additional information relating to Charles S. Bradley's process that is now being tried on the slime dumps at Anaconda. The material in these dumps is not amenable to treatment by any hitherto known method of concentration or lixiviation. The capacity of the Bradley plant is 250 tons per 24 hours. The slime is first roasted in an 'amphidizer' for the production of sulphate of copper and ferric oxide. The word 'amphidizer' is a new one. 'Amphigen' is defined as "an element that combines with the metal to form either an acid or a base"; an 'amphide' is "a salt of which the acidic and basic portions each contain an amphigen"; and 'amphidizing' is the process of producing the amphide. The necessity for this new nomenclature is not quite clear. The amphidizer is a horizontal rotating drum having a central heating flue and a burner at one end of the flue. The ore is fed into the annular part of the drum by a screw-feed at the opposite end to the burner. The annular space is divided into a series of compartments by vertical partitions; two sets of inclined cross-tubes lead from each compartment into the next but one. As the drum rotates, the ore passes toward the hot end through the first, third, fifth, etc., compartments, and then returns in the opposite direction through the alternate compartments to a delivery orifice at the charging end. The air required for oxidation follows the ore. The temperature of the reaction is from 450 to 550° C. On leaving the amphidizer, the ore is de-

livered to a reaction drum containing calcium chloride solution, maintained at a temperature of 100° C. Here cupric chloride is formed by the reaction of the copper sulphate with the calcium chloride, and any ferric sulphate in the ore reacts with the calcium chloride producing ferric chloride. Calcium sulphate results from both these reactions. The production of ferric chloride at this point is advantageous as it dissolves any copper oxide, copper sulphide, or metallic copper, and also because it maintains the copper chloride in the cupric state. The discharge from the reaction drum is then filtered for the removal of the gangue and of the precipitated calcium sulphate. Any zinc in the ore will be in solution, but any remaining arsenic has been rendered insoluble. The solution then goes through another oxidizer so as to ensure that the metals are all combined at their highest valency. The iron and alumina are subsequently removed by cupric oxide, and the precipitate produced, which contains copper, is returned to the amphidizer. The solution then goes to a second vat where the copper is deposited as oxide by the addition of carbonate of lime. Every now and then the solution is sent to another vat for the removal of the accumulated zinc salt, this being done by means of quick-lime. Any gold and silver present in the ore are dissolved by the action of chlorine, chlorous, or chloric compounds, the chlorides thus formed being soluble in the calcium chloride solution. They are subsequently precipitated along with the copper. Further information as to results is desirable. For instance, the cost of heating so much gangue may be prohibitive. Also there may be inconvenient reactions in the gangue in the roasting and dissolving operations.




*BRADLEY'S PROCESS FOR TREATING COPPER SLIME.*

**Mineral Factors.**—A valuable paper by G. T. Holloway was issued with the March *Bulletin* of the Institution of Mining and Metallurgy, entitled 'Notes on the Valuation of Ores and Minerals and on Metallurgical Calculations.' Owing to the March meeting of the Institution being occupied with general business and the presidential address, the paper received no mention on that occasion. Also, owing to the *Bulletin* containing an unusually bulky paper on another subject, referred to elsewhere, Mr. Holloway's contribution may run some danger of being overlooked. Mr. Holloway's desire was to provide figures which will help the engineer or commercial man in estimating how much of the metal or oxide is contained in a given weight of mineral, so as to thereby enable him to ascertain the relative value of minerals on the basis of the content of metal or substance desired, and also to check the efficiency of an extraction process. In a separate paragraph we quote his remarks on the sources and uses of manganese, and herewith we reproduce a portion of his tables. We recommend our readers to obtain the complete paper and to assist the author in extending his scheme.

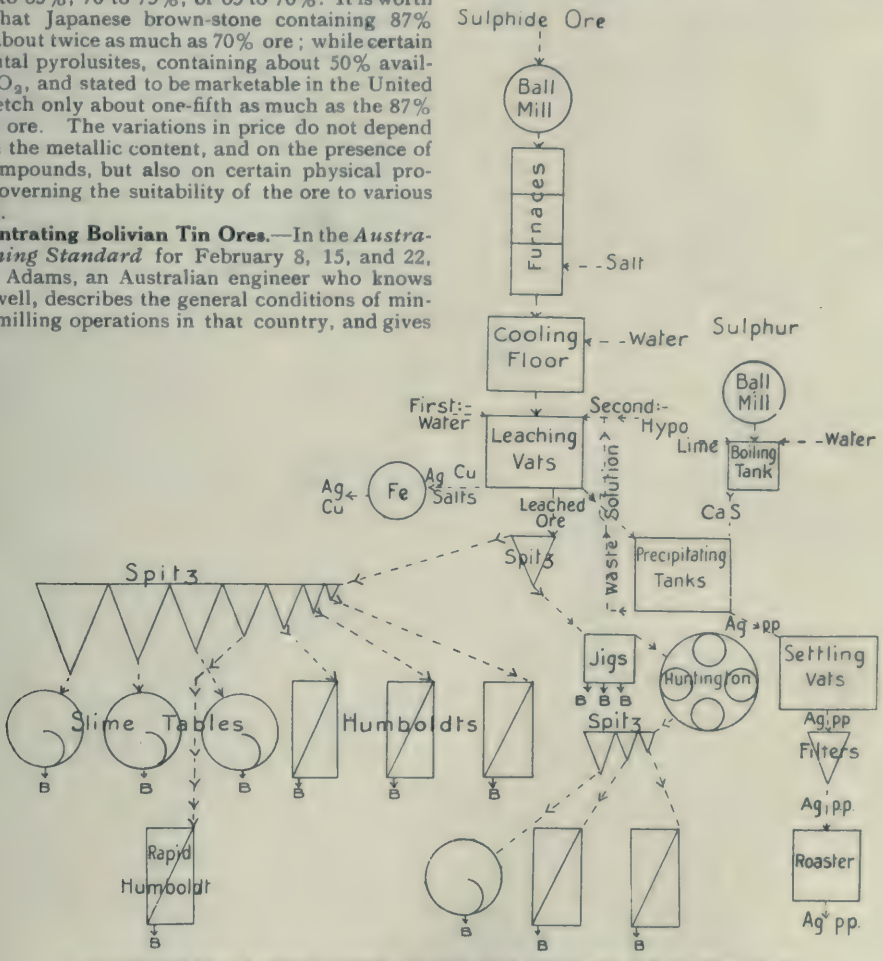
| A (Commercial Minerals) | B (Commercial Products desired) | Percentage of B in A |
|---|---|---|
| ALUMINIUM— | | |
| Potash Alum. $K_2SO_4.Al_2(SO_4)_3.24\,H_2O$ | $SO_3$ | 33·75 |
| | $Al_2O_3$ | 10·77 |
| | $K_2O$ | 9·92 |
| | $H_2O$ | 45·56 |
| Bauxite. $Al_2O_3.2H_2O$ | $Al_2O_3$ | 73·93 |
| ANTIMONY— | | |
| Stibnite. $Sb_2S_3$ | Sb | 71·42 |
| ARSENIC— | | |
| Mispickel. $FeS_2.FeAs_2$ | As | 46·06 |
| Realgar. $As_2S_2$ | As | 60·91 |
| Orpiment. $As_2S_3$ | As | 70·04 |
| BARIUM— | | |
| Barite. $BaSO_4$ | BaO | 65·70 |
| Witherite. $BaCO_3$ | BaO | 77·71 |
| BISMUTH— | | |
| Bismuthine. $Bi_2S_3$ | Bi | 81·22 |
| CALCIUM— | | |
| Calcite, etc. $CaCO_3$ | CaO | 56·03 |
| | $CO_2$ | 43·97 |
| Dolomite. $CaCO_3.MgCO_3$ | CaO | 30·41 |
| | MgO | 21·87 |
| Fluorspar. $CaF_2$ | F | 48·68 |
| | CaO | 32·57 |
| Gypsum. $CaSO_4.2H_2O$ | S | 18·63 |
| | $SO_3$ | 46·51 |
| COPPER— | | |
| Copper Pyrite. $Cu_2S.Fe_2S_3$ | Cu | 34·63 |
| Copper Glance. $Cu_2S$ | Cu | 78·95 |
| Erubescite. $3Cu_2S_3.Fe_2S_3$ | Cu | 43·45 |
| Malachite. $CuO.H_2O.CuCO_3$ | Cu | 57·49 |
| IRON— | | |
| Iron Pyrite. $FeS_2$ | Fe | 46·54 |
| | S | 53·46 |
| Pyrrhotine. FeS | Fe | 63·52 |
| | S | 36·48 |
| Chalybite. $FeCO_3$ | Fe | 48·21 |
| | FeO | 62·02 |
| Hematite. $Fe_2O_3$ | Fe | 69·94 |
| Limonite. $2Fe_2O_3.2_3H_2O$ | Fe | 59·82 |
| | $Fe_2O_3$ | 85·53 |
| | $H_2O$ | 14·47 |
| Magnetite. $Fe_3O_4$ | Fe | 72·36 |
| LEAD— | | |
| Anglesite. $PbSO_4$ | Pb | 68·31 |
| Cerussite. $PbCO_3$ | Pb | 77·54 |
| Galena. PbS | Pb | 86·59 |
| MAGNESIUM— | $CO_2$ | 52·18 |
| Magnesite. $MgCO_3$ | MgO | 47·82 |
| MANGANESE— | | |
| Manganite. $Mn_2O_3.H_2O$ | Mn | 62·46 |
| Pyrolusite. $MnO_2$ | Mn | 63·19 |
| MOLYBDENUM— | | |
| Molybdenite. $MoS_2$ | Mo | 59·94 |
| NITRATES— | $N_2O_5$ | 53·42 |
| Potash Nitre. $KNO_3$ | $K_2O$ | 46·58 |
| Soda Nitre. $NaNO_3$ | $N_2O_5$ | 63·53 |
| | $Na_2O$ | 36·47 |
| SILVER— | | |
| Argentite. $Ag_2S$ | Ag | 87·06 |
| TELLURIUM— | Fe | 55·63 |
| Sylvanite. Au Ag $Te_3$ | Au | 28·68 |
| | Ag | 15·69 |
| TIN— | | |
| Cassiterite. $SnO_2$ | Sn | 78·81 |
| TITANIUM— | | |
| Rutile. $TiO_2$ | Ti | 60·05 |
| TUNGSTEN— | CaO | 19·46 |
| Scheelite. $CaWO_4$ | $WO_3$ | 80·54 |
| Wolfram. $FeWO_4.MnWO_4$ | Fe | 9·20 |
| | Mn | 9·05 |
| | $WO_3$ | 76·47 |
| ZINC— | | |
| Blende. ZnS | Zn | 67·09 |

**The Commercial Aspects of Manganese Ores.**—We refer elsewhere to G. T. Holloway's paper on the calculations relating to the valuable contents of minerals. His remarks on the ores of manganese are of special interest. Manganese ores are in demand for two entirely different purposes. In the first place the chemist requires them on account of their oxygen content, and secondly the steel metallurgist wants them for their metal content. Pyrolusite, the peroxide of manganese ($MnO_2$), contains a maximum of oxygen in a cheap and portable form, and though the oxygen is not released under ordinary conditions, it is liberated with ease when required. Thus it is useful in the manufacture of chlorine and for disinfecting and other purposes. For these purposes admixtures of lime are objectionable, while the presence of phosphorus is of no account. On the other hand the steel metallurgist wants an ore containing a minimum of oxygen, such as manganite ($Mn_2O_3$, $H_2O$). He does not object to the presence of lime, and will in fact sometimes pay for it, but he fixes maxima for silica and phosphorus. Thus braunite, with its invariable association with silica, may be less desirable than the pyrolusite with its extra oxygen content. Other ores of manganese are psilomelane which contains barium, wad, a variable earthy mineral valuable chiefly as a pigment, rhodochrosite ($MnCO_3$), and franklinite. The last-named contains zinc, and is worked extensively in New Jersey, the zinc being driven off as oxide, and the residue smelted for the production of spiegeleisen.

In the sale of the ores, Russian, Indian, and Brazilian ores are valued according to the metallic manganese content, while those coming from Japan, Spain, and Germany are priced according to the peroxide content, this difference reflecting the various objects for which the supplies are sold. For manganese ores bought by metallurgists, 50% metallic content forms the basis of negotiations. In America the standard ores must contain not more than 8% silica and 0·2% phosphorus; for each per cent in excess of 8% silica a deduction of 15 cents per long ton is made, and for each 0·02% above 0·2% phosphorus there is a deduction of 2 cents per ton. If over 49%, the manganese is paid for at 26 cents per unit, and one cent is deducted per unit for every 3% less, while 5 cents is paid for each unit of iron present. If the manganese content is less than 40%, the parcels may be accepted or refused at will by the buyers. In England and Germany the supplies are so plentiful that a higher grade is demanded, and the 50% standard is maintained at 8d. or 9d. per unit, with a small bonus or penalization for each unit above or below the 50. The maximum silica to escape penalization is 8 to 9%, and phosphorus 0·15 to 0·2%, and variable deductions are made for any in excess. This basis is usual for Caucasian, Indian, and Brazilian, and other high-class ores, which are sold in lots

of thousands of tons, averaging from 50% to 55% of manganese and of remarkable uniformity. In the case of Turkish, Japanese and other ores, which are more variable, a basis of 45% manganese is common. For the former, a basis of 0·03% phosphorus and 10% silica is usual, while for the Japanese 'brown-stone' ore (pyrolusite or $MnO_2$) special rates rule. This brown-stone ore is specially suited for chemical purposes, and fetches a higher price than others per unit of manganese. It varies from about 43% to 56% manganese, from 7 to 10% silica, and carries about 0·5% phosphorus, and is commonly sold for its value in available peroxide, the schedule being agreed at so much per ton if from 85 to 90% $MnO_2$, or so much from 75 to 85%, 70 to 75%, or 65 to 70%. It is worth noting that Japanese brown-stone containing 87% fetches about twice as much as 70% ore; while certain Continental pyrolusites, containing about 50% available $MnO_2$, and stated to be marketable in the United States, fetch only about one-fifth as much as the 87% Japanese ore. The variations in price do not depend solely on the metallic content, and on the presence of other compounds, but also on certain physical properties governing the suitability of the ore to various purposes.

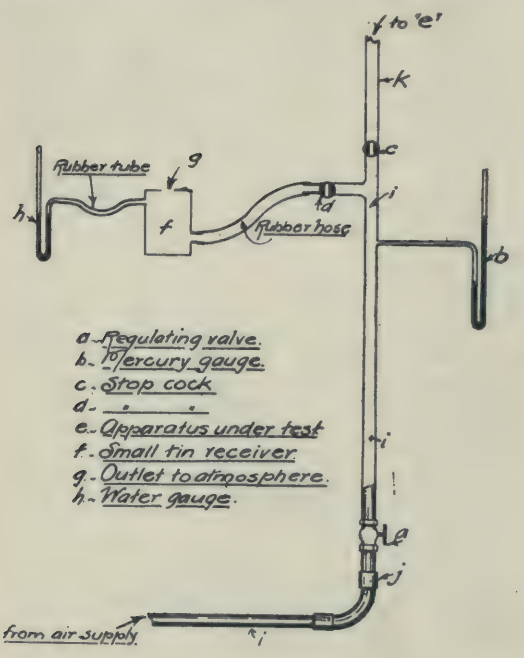
**Concentrating Bolivian Tin Ores.**—In the *Australian Mining Standard* for February 8, 15, and 22, O. Gore Adams, an Australian engineer who knows Bolivia well, describes the general conditions of mining and milling operations in that country, and gives details of the practice at a number of mines. We abstract herewith his description of the treatment of a complex ore by the Socavon de Oruro company, at their mill situated at Machacamarca, on the Antofagasta & Bolivia railway. The manager and engineer of this company are both Dutch. The ore is highly complex, containing tin, lead, copper, silver, gold, iron, antimony, and arsenic, and it is mined in both oxide and sulphide form. The treatment provides for the recovery of the first five metals named. The average silver content is 39 oz. per ton. The sulphide ore is crushed dry in a ball-mill having a 1 mm. diagonal slotted screen, and is then sent to roasting furnaces, where the sulphur constituent is reduced from 30 to 3%, the remaining sulphur being chiefly in the form of sulphate. Each furnace has three hearths, and on the last hearth 4% of sodium chloride is added. After cooling, the roasted ore is elevated to leaching vats, where it is first washed with water, and then with hyposulphite of soda. The result of the water wash is the removal of free salt and the soluble salts of copper and silver. The solution obtained is removed and passed over scrap iron, and a precipitate obtained averaging 50% copper and 250 oz. of silver per ton. The ore is then treated with ½% solution of hyposulphite, and the resulting solution is decanted to another vat where the metals are precipitated by calcium sulphide. The precipitate assays 35% silver, 23% lead, 2% copper, and 4 oz. gold. The above processes are made possible by the fact that salt, lime, and sulphur are natural products in the neighbourhood. The oxidized ore is ground in a ball-mill having 0·7 mm. apertures, and thence goes straight to the concentration plant for the recovery of the tin. There it is mixed with the residues from the leaching plant and is separated in spitzkasten into coarse and fine. The




*FLOW-SHEET OF EXTRACTION PLANT FOR SOCAVON DE ORURO ORES.*

spigot discharge goes to jigs, and the overflow to another series of spitzkasten, to be classified for treatment on Humboldt tables and on circular slime-tables. The tailing from the jigs is re-ground in a Huntington mill and treated on tables and slime-tables. The latest addition to the plant is a rapid Humboldt table with 340 strokes of ⅛ in. per minute. The various tailings are passed over buddles.

**Measuring Compressed Air.** — In the *Monthly Journal* of the Chamber of Mines of Western Australia for January, G. S. Weymouth of the Great Fingall mine describes a simple apparatus for measuring the amount of compressed air used in such operations as the agitation and aeration of slime. It is not claimed that this apparatus is as exact as some of the expensive scientific instruments on the market, but that with




the exercise of a little judgment results can be obtained that are sufficient for the ordinary requirements of the practical metallurgist. The pipe (*i*) carries the compressed air to the plant where it is used (*e*), and a branch pipe carries the air to the measuring apparatus (*f*). There are cocks at (*a*) (*c*) and (*d*), a mercury gauge at (*b*), and a water gauge at (*h*). The receiver (*f*) may be an ordinary tin can, and it has a discharge orifice at (*g*), the area of which may be varied according to circumstances. The rate of supply to (*e*) is regulated to requirements by means of the cock (*a*), the cock (*d*) being closed and (*c*) open, and the height of the mercury in (*b*) is noted. The cock (*c*) is then closed and (*d*) opened to such an extent that the height of the mercury in (*b*) is the same as before. The height of the water gauge is then noted, as also is the area of the orifice (*g*). The velocity through (*g*) is that due to a head of air equivalent to the pressure in the water gauge. For comparatively low pressures, such as are used in agitation, it is possible to deduce the formula

$$\text{cubic feet of free air per second} = 42{\cdot}3 \times \sqrt{h}$$

where $h$ is the height of the water gauge in inches.

One square inch is the most generally convenient size for the orifice (*g*), but by means of screw-caps with various apertures, the area may be altered from ⅛ sq. in. to 4 sq. in. The vessel (*f*) may be anything from a 2-pint measure to a kerosene can, the latter being suitable for an air-lift consuming 50 cu. ft. per minute.

**Profits in Coal Mining.**—In a paper on the valuation of mineral properties read before the South Staffordshire and Warwickshire Institute of Mining Engineers on February 19, the author, T. A. O'Donahue, the Government valuer under the Estates Duty Act, gave an estimate of the average profits made by coal-owners in Great Britain. He carries forward to 1910 the calculations made by Lord Joicey in 1901, based on the Board of Trade returns. Lord Joicey's figures for 15 years, 1886 to 1900, were as follow :

| | |
|---|---|
| Total output ..... | 2,802,395,000 tons |
| Value at pits' mouth..... | £953,477,000 |
| Average value per ton ..... | 6s. 9·65d. |
| Expenditure on wages ..... | £642,386,000 |
| Average ditto per ton ..... | 4s. 7·01d. |
| Remaining for expenses other than wages and for coal-owners' profit..... | £311,091,000 |
| Ditto per ton ..... | 2s. 2·64d. |

He took 1s. 6d. per ton as expenditure on material, rents or royalties, salaries, etc., and thus obtained 8·64d. as the coal-owners' profit per ton. He estimated that £110,000,000 represented the capital invested in the mines, or 11s. 9d. per ton per annum. Thus the rate of interest would be about 6%, without allowing for the redemption of capital. Other experts, such as J. B. Simpson and J. H. Merivale, considered that 1s. 6d. per ton was too low for the other expenses, and mentioned 6d per ton as nearer the mark for the owners' profits. Mr. O'Donahue has carried the calculations, based on the Board of Trade returns, forward to the end of 1910 and gives the figures for the 25 years 1886 to 1910 as follow :

| | |
|---|---|
| Total output ..... | 5,256,124,000 tons |
| Value at pits' mouth..... | £1,946,928,000 |
| Average value per ton ..... | 7s. 4·9d. |
| Expenditure on wages ..... | £1,317,740,000 |
| Average ditto per ton ..... | 5s. 0·1d. |
| Remaining for other expenses and coal-owners' profits ... | £629,188,000 |
| Ditto per ton ..... | 2s. 4·8d. |

It will be seen that the expenditure on wages is 68% of the value of coal at the pits' mouth. The author considers that the Board of Trade figures for the value are a little too low, and that the figures for wages are rather too high, and that therefore it is probable that Lord Joicey's figures for 'other expenditure' per ton were quite likely to be the more correct ones. In deducing his figures for the 25 years 1886 to 1910 the author follows Lord Joicey's method and finds that 1s. 8d. may be taken as the figure for 'other expenditure.' Of this, 1s. 2½d. would be cost of materials, salaries, etc., and 5½d. the rent or royalty. Thus the coal-owners' profit would be 8·8d. per ton. The author adopts 12s. 6d. as the capital expenditure per ton per annum. The yield per cent would therefore be 5·86 without allowing for redemption of capital; if 30 years is allowed for redemption 2% would be required, so that 3·86% is the yearly yield on capital employed in British coal mines. Mr. O'Donahue with his vast experience of valuation may be taken as reliable, and his present position gives a judicial air to his opinions.

**Mine Explosions.**—At the meeting of the Manchester Geological and Mining Society held on February 27, John Harger, of Liverpool University, read a paper ad-

vocating an organized lowering of the oxygen content of the air in coal mines, having as its object the minimizing of the risk of explosion of coal dust and of the burning of the coal and mine timbers. Naturally this proposition had a doubtful reception, for it ran counter to all preconceived notions as to ventilation. Mr. Harger commenced by arguing that ventilation caused the atmosphere, the timbers, and the workings generally to become dry, thus encouraging combustion or explosion. In fact, with the new regulations in this country, the dry mines were becoming rapidly more dangerous. Admitting that ventilation was necessary, his remedy was to regulate the amount of oxygen and carbonic acid in the currents of air. His proposition was to use in the dangerous mines an atmosphere containing 19 to 19¼% of oxygen and ¾ to 1% of carbonic acid, while in the majority of mines 20% oxygen and ½% carbonic acid would be suitable. It would be possible to obtain these admixtures by adding definite proportions of flue gas to the entering air. The flue gas would have to be scrubbed for the removal of dust, sulphurous acid, carbon monoxide, etc. This artificially polluted atmosphere would, it was argued, be such as to prevent dust explosions, while it would not have any deleterious effect on the workers. In the case of mine fires, the amount of flue gas sent into the workings could be increased

# CURRENT LITERATURE.

**Gold Dredging in California.**—The *Journal* of the American Society of Mechanical Engineers for February contains an elaborate article by Robert E. Cranston on the design and mechanical features of the California gold dredge.

**Electrolytic Determination of Lead.**—In *Metallurgical and Chemical Engineering* for March, Elmer List describes the Guess-Haultain electrolytic method for rapidly determining lead in large or small amounts.

**Assaying Silver Bullion.**—The March *Bulletin* of the American Institute of Mining Engineers contains a paper by L. E. Salas describing a modification of the Gay Lussac method of estimating silver bullion, for use when much tin is present, as is often the case with Mexican and Bolivian products.

**Refractory Materials.**—In *Metallurgical and Chemical Engineering* for March, F. A. J. Fitzgerald gives the results of researches with regard to the physical properties of a number of refractory materials, alundum, crystolon, magnesia, and lime.

**Blast-Roasting.**—In *Metallurgical and Chemical Engineering* for March, H. B. Pulsifer commences an article reviewing the history and progress of blast-roasting. A useful feature is a full bibliography on the subject.

**Rocks and Minerals at Homestake.**—In *Economic Geology* for December, W. J. Sharwood presents a series of analyses of rocks and minerals at the Homestake gold mine, Dakota. The data presented form a useful chemical adjunct to Irving and Emmons' work on the geology of this mine.

**Smelting Low-grade Iron Ores.**—The *Mining and Engineering World* (Chicago) for March 9 contains an article describing J. T. Jones' experiments on the beneficiation of the low-grade silicious iron ores of Michigan and Minnesota. The process is based on the method of reducing the iron to a metallic state by contact with volatile hydrocarbons or by an admixture of coke, and afterwards removing it from the gangue either by the magnet or by fusion. The experiments have not so far resulted in a practicable process.

**Butte Copper Deposits.**—In *Economic Geology* for January, C. T. Kirk reviews recent evidences obtained at the Butte mines as to the formation and mineralization of the rocks in the district.

**Ore Dressing at Joplin.**—A series of articles on concentration methods at Joplin, Missouri, dealing with zinc-lead ores, written by J. L. Bruce, commenced in the February 24 issue of the *Engineering and Mining Journal*.

**Data on Vulcanism.**—In *Economic Geology* for January, A. N. Winchell presents an abridged translation of Brun's paper entitled 'Recherches sur l'Exhalaison Volcanique,' giving in particular the tables relating to the heat of lavas, namely, the fusing points, explosion temperatures, and calorific capacity, and to the amount of gases contained in rocks and lavas under varying conditions.

**Mineral Resources of China.**—The March *Bulletin* of the American Institute of Mining Engineers contains an elaborate article by Thomas T. Read on the mineral production and resources of China.

**The Diesel Oil Engine.**—At the meeting of the Institution of Mechanical Engineers held on March 15, Rudolph Diesel read a paper reviewing the history of the development of the Diesel oil engine and discussing the economic aspects of its application.

# BOOKS REVIEWED

A TEXT-BOOK OF RAND METALLURGICAL PRACTICE. —Vol. I. By W. A. Caldecott and others. Half-leather, octavo, 480 pages with many illustrations. London: Charles Griffin & Co. Price 21s. For sale by *The Mining Magazine*.

Without doubt this is one of the most important books on metallurgical practice ever published. There is more than one reason that prompts us to pay this tribute to the authors. In the first place the Rand is the greatest goldfield on record and the various mines are so numerous and so close together that a large population of technical men is present and the individuals have constant opportunity for interchange of opinions and experience. This aspect is well demonstrated by the unrivalled character of the papers and discussions at the monthly meetings of the Chemical, Metallurgical, and Mining Society. These meetings are held regularly throughout the year without a break; they are well attended by men who are interested in one branch of metallurgy and all in 'dead earnest.' The present book shares the characteristics of the *Journal* and *Proceedings* of that society, and those who know and appreciate the Society's work will desire no higher recommendation than this favourable comparison of the new book with the publications in question.

The next reason for commending the book is that the various divisions of the subject are treated by men who have had special experience in them. We have quoted the authors as 'W. A. Caldecott and others,' but on the title page Mr. Caldecott's name does not receive this special prominence, the list of authors appearing in the same order as the chapters for which they are responsible. As however we know that in the conception, inauguration, and successful production of the book Mr. Caldecott played a leading part we think it right to take this opportunity of awarding him the largest share of honour. Though we give this preponderating amount of credit to him, the individual chapters are so excellent that they are entitled to as great an amount of praise as would be given to a high-class book produced by a single author. A book may be valuable

for many reasons which need not be detailed on this occasion. Suffice it to say that the present book owes much of its value to the fact that the authors all draw on their own experience and present the reader with first-hand information.

It would be quite out of place in this review to discuss the comparative merits of the many details in method and practice on the Rand. Metallurgists in other parts of the world, with more perspective but with less intimate knowledge of circumstances, have not been slow to accuse their confreres on the Rand of parochialism. That Rand practice is not always of general application elsewhere is due largely to the different economic circumstances and the special features of the ore deposits. On the other hand, in recent years the Rand metallurgists have not hesitated to examine and adopt ideas emanating from other centres of activity. We will however not pursue these general considerations further, and will content ourselves with saying of this book that it brings together for the first time in readily available form full descriptions of present Rand practice.

We proceed to give a detailed description of the contents of the book. The first chapter is by Ralph Stokes and gives a convenient outline of the history of the Rand, its geology, and economic problems. Mr. Stokes is well known as an author and journalist, and he combines with these qualifications his experience underground at the Crown Mines. To show the thoroughness of the Rand engineer, we may mention that Mr. Stokes has for the last year been in this country making a close study of underground methods in collieries, iron mines, and tin mines. The next chapter describes the sorting and breaking methods, and is written by J. E. Thomas, manager of the metallurgical plant of the Simmer Deep and Jupiter mines. Mr. Thomas also contributes the chapter on the cyanidation of sand. G. O. Smart, of the Simmer & Jack, takes the stamp-mill as his subject, and W. R. Dowling, of the Knights Deep, the tube-mill and slime practice. H. A. White, metallurgist to the Goerz group, discusses the principles of slime treatment. E. H. Johnson, metallurgist to the East Rand Proprietary, takes precipitation, cleaning-up, and smelting as his subjects. A. M'Arthur Johnston, metallurgical chemist to the Consolidated Gold Fields, is the author of the chapters on assaying and testing. Finally, W. A. Caldecott reviews the chemical and metallurgical problems connected with the treatment of banket ore. At the end of the volume there are sixty pages containing metallurgical tables of all sorts and skeleton report forms, collected and arranged by Mr. Caldecott and Mr. White.

The present book will be supplemented in a short time by a second volume, the bulk of which will be occupied with the mechanical considerations connected with the design and construction of plants and the methods of transporting ore, pulp, tailing, etc., which is being written by C. O. Schmitt. In concluding this review we may remark that the majority of the authors belong to the staff of the Consolidated Gold Fields group.

DEPRECIATION AND WASTING ASSETS. By P. D. Leake. Cloth, octavo, 200 pages. London: Henry Good & Son. Price 10s. 6d. For sale by *The Mining Magazine*.

The thoughtful mining engineer will welcome this book and will desire to present a copy to each of his friends and acquaintances connected with the administration of mines and mining companies. Various circumstances have prevented the general adoption of sound financial principles in London in connection with mining ventures, the chief one being that money is attracted to this class of enterprise chiefly for the sake of the prizes occasionally secured on the Stock Exchange, and rarely for a legitimate investment. Another circumstance is that the average director knows little of the principles of finance, and so allows the real controllers to secure the presentation of reports and accounts that are most favourable to Stock Exchange interests. Thirdly, the income tax authorities, for their own ends, set up a code utterly opposed to the interests of sound finance. Much might be written on this subject, but we will not do so here, because it is all so much better said in Mr. Leake's book. Suffice it to say that in the case of wasting assets, capital expenditure should be rapidly replaced from profit and loss, and that nothing at a mine should be taken as an asset of permanent value. It is true that most companies make deductions for depreciation of plant and buildings, and some of them redeem the development expenditure on main shafts, but those that take the contents of the mine as a wasting asset can be counted on the fingers of one hand. The Tharsis company has replaced the book value of the mine by cash and has over a million pounds sterling in its treasury; Mason & Barry devoted profits to the repayment of capital, and reduced the denomination of the shares accordingly; the Mountain Copper Co. converted shares into redeemable debentures. It is true that many mining engineers have written much during recent years advocating the adoption of a reasonable attitude towards the principle of amortization. Unfortunately however most of these writers are in favour of the shareholders seeing to this matter for themselves and applying the principle to their individual investments. This shows a confusion of ideas between depreciation of property and depreciation of investments. The primary responsibility for the preservation of the capital of the shareholders rests with the directors and not with the shareholders themselves.

GEM-STONES. By G. F. Herbert Smith. Cloth, octavo, 312 pages with coloured plates and other illustrations. London: Methuen & Co. Price 6s. For sale by *The Mining Magazine*.

A few months ago we gave a hearty welcome to L. J. Spencer's book on the 'World's Minerals,' and described it as a short and clear account of the chief minerals, written for the general reader by one who is a thorough master of mineralogy. The present book on gem-stones may be best described as a worthy companion. Both authors are connected with the British Museum and have the fortunate gift of writing in a way that is clear and interesting to the man of average education. Since we started the publication of this magazine we have reviewed several books on precious stones and have lamented the absence of a high-class handbook on the subject. No book smaller than Bauer's great volume has met with our approval. Many of the recent books on precious stones ought to bear the title 'precious nonsense' instead; while some of the earlier works, being written by tradesmen or lapidaries of small scientific attainments, do not satisfy the genuine inquirer after knowledge. Mr. Smith's book fills the vacant niche and we shall ever recommend it to our friends.

The first chapter describes the physical characteristics of gem-stones, crystalline form, reflection, refraction, and dispersion, lustre and sheen, colour and dichroism, specific gravity, hardness and cleavability. The second chapter deals with nomenclature, lapidary's work, and manufactured and imitation stones. Part three is devoted to the precious stones, namely,

the diamond and the corundum and beryl group. Then follows a long chapter on semi-precious stones, from topaz and spinel to opal and turquoise, and chapters on ornamental stones such as lapis lazuli and marble and serpentine, and on stones of organic origin, namely, pearl, coral, and amber. Finally there are tables of hardness, colour, etc.

The descriptions of the determination and identification of various stones are of interest, as are also the accounts of celebrated stones, and of the methods of cutting and polishing. But the part that appeals the most to us is the chapter on semi-precious stones, for it is in this part of the subject that the dilettante can find the greatest enjoyment. It is not everybody that can afford the ruby and it is indeed doubtful if those who can afford obtain so much pleasure as the humbler student of kunzite, peridot, and moonstone. In conclusion we may say that it is remarkable how little is generally known about gem-stones, probably because of the absence of a popular handbook. If Conan Doyle had been possessed of a reliable book of this sort he would not have sent Sherlock Holmes on a hunt for a 'blue carbuncle.' He would have called the missing stone a sapphire cut *en cabochon*. The word 'carbuncle' means a little spark of fire from carbon and involves the idea of a red glow. Also the celebrated investigator of crime is made to hunt for a particularly valuable 'beryl coronet.' The word 'beryl' conveys no intimation of special value any more than 'corundum.' When beryl is precious it is an emerald or an aquamarine; when corundum is precious it is a ruby or sapphire. Thus the word beryl is of no significance as regards value.

THE STUDENT'S HANDBOOK OF STRATIGRAPHICAL GEOLOGY. By A. J. Jukes-Browne. Second Edition. Cloth, octavo, 667 pages with many illustrations. London: Edward Stanford. Price 12s. 0d. For sale by *The Mining Magazine*.

Mr. Jukes-Browne's book on the geology of the British Islands is well known, and is valuable to the student of stratigraphy and paleontology. The new edition contains many additions and revisions, but the most important feature is the inclusion of the geology of Europe in its scope. The author does not undertake any description of the rocks of the rest of the world, nor to correlate the history of the various continents, and from the point of view of precision in detail his policy is acceptable. His careful though rather tentative introduction of European geology is of decided value to the English student. He promises in a future edition to extend these comparisons of English and European geology. We note an error in the map of the northwestern counties of England on page 260, St. Bees Head in Cumberland appearing as St. Abb's Head, the latter being the name of a promontory in Berwickshire, Scotland.

GEODETIC SURVEYING, AND THE ADJUSTMENT OF OBSERVATIONS (METHOD OF LEAST SQUARES). By Edward L. Ingram. Cloth, octavo, 390 pages, illustrated. New York: McGraw-Hill Book Co. Price 12s. 6d. For sale by *The Mining Magazine*.

This book has been written for the civil engineering students in the University of Pennsylvania, and it is divided into two parts separating the practice from the theory and mathematics. It will be found of great service to the mining engineer and pioneer having large tracts of undeveloped country under his charge. The fact is that this branch of surveying has not been the subject of a special treatise for a good many years and there is no such book extant at the present time, so that Mr. Ingram's labours will be appreciated by a large circle of clients. As the book starts from the first principles of triangulation and levelling, and describes methods, practice, and the use of the instruments, a reader with only a small amount of preliminary knowledge can follow the instructions. On the other hand, the more advanced student and the experienced surveyor will find in the second part of the book a complete discussion of the accuracy of results and other considerations relative to the theory and practice of this branch of survey-work.

STAMP MILLING.—By Algernon Del Mar. Cloth, octavo, 135 pages, illustrated. New York: McGraw-Hill Book Co. Price 8s. 6d. For sale by *The Mining Magazine*.

Stamps have lately been considered so much in relation to their crushing capacity that it is apt to be overlooked that they are also held in favour because of the facilities they offer for amalgamation. It is therefore opportune that amalgamation practice occupies many pages of this book, the details being drawn chiefly from the author's own experience in California. On the other hand the stamp as a crushing machine is not adequately discussed, as will be evidenced by the fact that grading analyses are conspicuous by their absence. Interesting and comprehensive details of ordinary working practice are given, together with general descriptions of the evolution and properties of the stamp-mill. In addition the construction and design of mills are described with the help of examples from recent equipments in South Africa and the United States. The book, while acceptable, would have been much improved if it had been properly edited.

S. J. TRUSCOTT.

PETROGRAPHIC METHODS. Translated from the German of Ernst Weinschwenk by Robert Watson Clark. Cloth, Octavo, 400 pages, illustrated. New York: McGraw-Hill Book Co. Price 15s. For sale by *The Mining Magazine*.

The books by Professor Weinschwenk of Munich on the examination of rocks by the microscope have proved of service to German students, so that this translation by Mr. Clark, of the University of Michigan, is welcome.

DICTIONARY OF ENGINEERING TERMS IN ENGLISH AND SPANISH. By Andres Garcia, rewritten and enlarged by W. N. Cornett. Cloth, pocket size, 230 pages. London: Hirschfeld Brothers. Price 4s. For sale by *The Mining Magazine*.

The new edition of this English-Spanish dictionary of engineering terms is a marked improvement on that originally published six years ago. Over 2500 new words have been added, and the index in both English and Spanish greatly facilitates research. The book shows an intimate knowledge of practical technology, and therefore will be of more service to the average engineer than the dictionaries compiled by people with literary skill rather than knowledge of everyday usage.

WIRING CALCULATIONS FOR ELECTRIC LIGHT AND POWER STATIONS. By G. W. Lummis Paterson. Cloth, small octavo, 96 pages. London: Scott, Greenwood & Son. Price 5s. For sale by *The Mining Magazine*.

This book contains a large number of tables facilitating the calculations necessary in designing circuits for electric light and power. The principles of the calculations are all fully described and discussed in phraseology suited to the general engineer. We recommend the book to the notice of the mining man who has or is likely to have an electric installation under his control.

# COMPANY REPORTS

**Quincy Copper.**—This company was originally formed in 1848 to work the copper mine of this name at Hancock in the centre of the Lake Superior copper district. Dividends commenced in 1862, and up to the end of 1911 the total distribution has been $19,880,000. Since 1900 great improvements have been made in the system of development, and in the methods of hauling and concentration. In addition, the property controlled has been extended by the acquisition of the Franklin and Pewabic mines. The copper is found in amygdaloidal melaphyre, which is crushed in steam stamps and jigged. The concentrate is called 'mineral,' and it contains about 60% metal. The amount of ore raised is 4000 tons per day, averaging 15 lb. per ton.

*The Michigan Copper District.*

The deepest workings are 5200 ft. down on the dip of the lode, which lies comparatively flat. The deepest workings in the Lake Superior region are 8200 ft. on the dip. The report of the company for 1911 shows that developments have fully maintained the reserves, and that there is no indication of any change in the nature of the orebodies. During the year, 1,382,524 tons of ore was raised and stamped, yielding 32,550,440 lb. of 'mineral,' from which 22,252,943 lb. of refined copper was produced. The income from the sale of the copper was $2,831,799. The working cost was $2,258,485, and expenditure on construction $106,581. There were other small items of income and expenditure, and the eventual net profit was $507,596. Out of this $440,000 was paid as dividend. The directors report that during the year a lighter type of rock-drill has been adopted, and that many improvements in the classifiers and jigs have been introduced by the advice of R. H. Richards.

**Trethewey Silver-Cobalt Mine.**—This company was formed in 1906 to acquire a shipping mine in the northern part of the Cobalt district, Ontario, from W. G. Trethewey. This mine, though not the oldest in the district, was the first to draw outside attention to the importance of the silver deposits. The report for the year 1911 now issued shows that the company has arrived at a period when a new system of development will have to be arranged. The area belonging to the company has by no means been completely prospected, so that there is apparently some encouragement to proceed. The output of silver was less than in 1910 owing to the fact that the milling ore was obtained from old workings from which the high-grade ore had been removed in previous years. The yield of silver was 770,838 oz., as compared with 865,777 oz. in 1910. Of the output, 284,407 oz. was contained in high-grade shipping ore, and 486,431 oz. in the concentrate derived from the treatment of 33,339 tons of lower-grade ore. The revenue was $372,622, the expenditure $212,316, and the profit $160,306, as compared respectively with $437,552, $199,751, and $237,800 in 1910. The profit was also smaller than during the years 1908 and 1909. The increase in cost is due to the greater expenditure on underground exploration and development work. During the past year it has been necessary to seek a new source of water-supply, as the requirements of the town of Cobalt have so much increased that no water was available from the adjoining Sasaginaga lake. The Trethewey therefore joined with its neighbours, the Coniagas, Buffalo, and Hudson Bay companies, and installed a pumping station at Mud lake farther to the west. The report states that other properties have been examined during the year with a view to purchase. Charles A. O'Connell is manager.

**Temiskaming.**—This company was formed in 1906 to work the silver mine of this name at Cobalt, Ontario. The control is in Toronto, and Norman R. Fisher is manager. Dividends were first paid in 1908. The production of silver has not been regular, though on the whole progressive. For the 9 months to January 31, 1908, the figure was 452,229 oz.; the succeeding two years gave 976,027 oz. and 676,675 oz.; then the 11 months February 1 to December 31, 1910, showed a great increase to 1,872,708 oz., and for the year 1911 the yield has fallen to 1,213,754 oz. Until the beginning of 1910 the production came from shipping ore, and in that year the concentrating plant commenced operations, 532,903 oz. of the production coming from that source. The figures for 1911 show 667,011 oz. from high-grade ore and 546,743 oz. from concentrate. The income from the sale of products was $643,322 and the profit $271,423, out of which $225,000 has been paid as dividend. A year ago the profit was $714,319. Mr. Fisher reports that the prospects for the future have changed since he wrote a year ago, as a number of the veins on passing downward from the

Keewatin to the diabase sill lose their value, so that exploration and development laterally will have to be adopted.

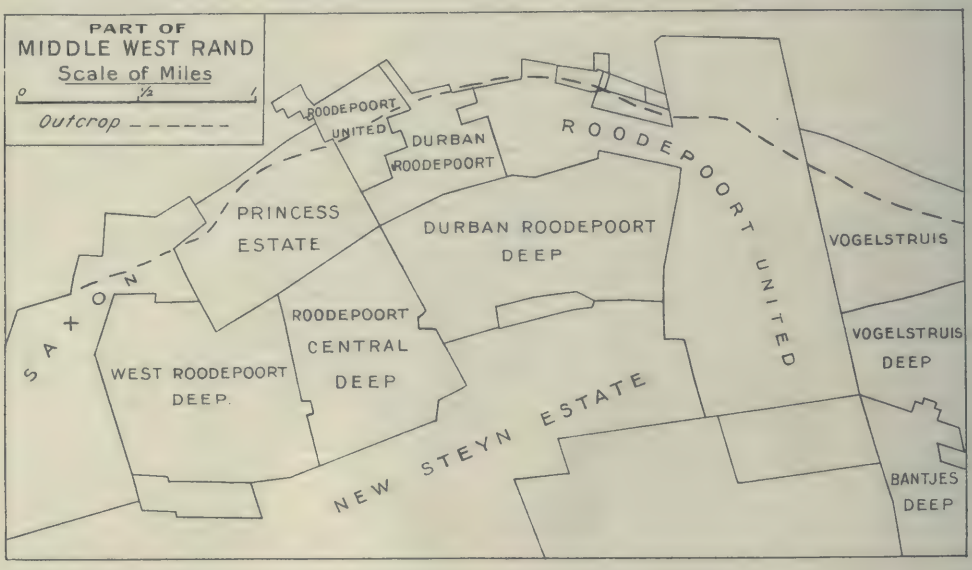
**Mount Boppy.**—This gold mine, situated in the Cobar district of New South Wales, is managed by John Taylor & Sons, and James Negus is superintendent. The company was formed in 1899, and at the time of flotation the metallurgical plant of the Gallymont mine in the same colony, that had been worked by the same group, was acquired. Production commenced in 1901 and dividends were first paid in 1902. From 1905 to 1908 the yearly dividends were at the rate of 47½% on the capital £121,000. Since the latter year the grade of the oxidized ore has declined slightly, and in addition the veins have come into sulphide ore that is not so efficiently treated by the plant. The report for the year 1911 shows that the conditions have continued to be generally much the same as in 1909 and 1910, but, owing to labour trouble chiefly, the output of ore and of gold, as well as the profits, have declined. A dividend of 20% however has been paid, as compared with 27½% in 1909 and 35% in 1910. The mill of 60 stamps ran for 290 days, crushing 43,645 tons of oxidized ore and 30,487 tons of sulphide ore, which by amalgamation and cyaniding yielded 26,405 oz. gold, or 7 dwt. per ton milled. These figures compare with 47,082 tons of oxidized ore, 31,608 tons of sulphide ore, 31,486 oz. gold, and 8 dwt. per ton, during 1910. The gold extracted during 1911 produced an income of £111,224, and the profit was £30,666. Out of this, £2949 was paid as income tax, and £4049 was allowed for depreciation. The dividends absorbed £24,200. The decreased yield was due largely to the impossibility of working some of the better-grade ore in the upper levels, owing to the ground becoming dangerous. Arrangements are now being made for recovering this ore by means of an open-cut from the surface. We recorded last year that a new plant was to be built on the all-sliming principle for the purpose of treating the sulphide ore. This plant is now being constructed and should be at work before long. Mr. Negus gives complete details of underground development, and shows that at the 500 and 600 ft. levels the results are promising. At the 600 ft. level the sulphides are found to contain an increasing amount of zinc blende, a mineral which in this mine is usually highly auriferous.

**North Broken Hill.**—This prosperous silver-lead-zinc mine on the Barrier Range, New South Wales, still continues to suffer from scarcity and dearness of labour, an adverse circumstance which is general in the district and in many other parts of Australia. Consequently the output is rather less than the capacity of the plant, and the figures for the half-year ended December 31 last are much the same as during the previous half-year. The amount of ore raised and treated in the lead concentration plant was 128,691 tons, assaying 16·1% lead, 13·6% zinc, and 6·8 oz. silver. The yield of lead concentrate was 22,441 tons, averaging 71% lead, 6·3% zinc, and 21·49 oz. silver. In addition 66,026 tons of zinc tailing was produced, averaging 18% zinc, 3·93% lead, and 3·68 oz. silver; this was sold to the Amalgamated Zinc (De Bavay's) for treatment. Also 11,534 tons of slime was recovered, assaying 13·4% lead, 16·5% zinc, and 8·6 oz. silver; the destination of this is not mentioned, but presumably it will follow the old slime dump recently sold to the Junction North company, for there is no mention of the company's own slime plant being yet in operation. The receipts from the sale of concentrate, tailing, and slime were £221,275, and the working profit was £112,643. Out of this, management expenses took £3083, depreciation of plant £12,168, and taxes £6000; £20,000 was placed to reserve, and £61,250 paid as dividend, comparing with £52,500 during the previous half-year. The balance, some £20,000, was carried forward. The working cost per ton of ore, including development, shows a still further advance of 10d., to 14s. 7d. The advance during the previous half-year was 1s. 4d. This is due to the rise in wages. Fortunately the effect of the rise is counteracted by the higher price of the metals. The developments at depth continue to be very satisfactory. The 1250-ft. level is now being actively opened up. At the point where the main cross-cut intersected the lode on this level the width of the ore-body was 74 ft., and the second cross-cut, 100 ft. to the south, has been driven 50½ ft. and is still in good ore. Assuming that the average width is the same as on the 1100-ft. level, George Weir, the manager, is able to give the reserve at 2,000,000 tons.

**Broken Hill South.**—As was the case with the North mine, as described in the above paragraph, so the South has suffered from scarcity of labour and high wages; but in spite of this fact, W. E. Wainwright, the manager, was able to effect a reduction in the cost per ton during the half-year ended December 31 last, from 17s. 1d. to 16s. 6d. He has also been able to greatly improve the extraction, as detailed later. The output of ore was 181,790 tons, averaging 14·4% lead, 14·1% zinc, and 6·9 oz. silver. The tonnage was 6700 tons higher than in the previous half-year, and the average silver and zinc contents slightly greater. The lead plant produced 27,339 tons of lead concentrate, averaging 71·9% lead, 5% zinc, and 24·5 oz. silver, and 123,969 tons of zinc tailing, averaging 16·7% zinc, 3·4% lead, and 3·6 oz. silver. The latter figures show a noteworthy improvement, for during the previous half-year only 95,990 tons of zinc tailing was produced. The zinc in the 123,969 tons of tailing consists of 81½% of the total zinc in the ore, a figure comparing with 71% the previous half-year, and only 46·6% in the early part of 1909. Mr. Wainwright has been helped to some extent in this matter by the De Bavay company accepting a lower-grade tailing, as is indicated by the following comparison of average assays: January to June, lead 3·7%, zinc 17·6%, silver 3·8 oz.; July to December, lead 3·4%, 16·7% zinc, and 3·6 oz. silver. It is clear therefore that the De Bavay people have improved their zinc concentration plant as much as Mr. Wainwright has improved his lead plant. The sale of lead and zinc concentrates realized £323,685, and the working profit was £158,423. From the latter sum had to be deducted administration expenses, taxes, and depreciation, together accounting for £16,000; 20,000 was placed to suspense account, being advance payments for tailing; and £90,000 was distributed as dividend, as compared with £60,000 during the previous half-year. The company still has on hand 1,430,000 tons of accumulated tailing and slime. As regards the ore reserves, these are reported to have been fully maintained at 3,000,000 tons. It is interesting to note that there is an expectation of another supply of ore being found in the company's property, as the orebody on the 1200-ft. level of the Central mine, belonging to the Sulphide Corporation, is pitching into the South mine.

**West Rand Consolidated.**—This company was formed in 1903 as an amalgamation of a number of properties and share interests in the far west Rand, and in 1907 the whole of the shares of the Violet company were acquired. The control is with the Albu group, and Robert Pill is manager. Milling commenced in 1908, and the metallurgical plant now con-

sists of 100 stamps and 4 tube-mills. The property contains the Main Reef series, and also the parallel Battery Reef further to the southeast, and work is being done on both. The report for 1911 shows that 359,249 tons was raised, of which 8% came from the Battery Reef. After the removal of 11% waste, 319,640 tons was sent to the mill. The yield was 53,958 oz. by amalgamation and 32,640 oz. by cyanide, making a total of 86,598 oz., worth £366,401, or 22s. 11d. per ton milled. The working cost was £317,496 or 19s. 10d. per ton, leaving a profit of 3s. 1d. per ton. Other revenue brought the income to £58,328. Out of this, £28,750 was paid as debenture interest, £4039 as taxes, and £4467 was allowed for depreciation of stores. No dividend on the shares was paid in 1910 or 1911, the only distribution being £74,228, or 3¾%, for 1909. Mr. Pill estimates the reserve at 1,003,000 tons averaging 5¼ dwt. The cost of mining has been rather higher during 1911 owing to the scarcity of native labour, and for the same reason it has been found necessary to 55 out of the 100 stamps having been at work. The cause for this condition of things is the delay in putting the chief shaft in order and the consequent hindrance to development work. In fact the ore reserve has for the same reason not been maintained during the year, the figures at the end of 1911 being 448,000 tons averaging 5½ dwt., a decrease of 168,935 tons. The revenue for 1911 from the sale of gold was £397,384 and the working cost £315,487. In addition £8428 was paid as tax, and £16,237 as interest on £197,934, the loan advanced by the parent company, the General Mining & Finance. The profit for the year was £60,638, which was carried forward. It will be seen, from the figures of production and cost for 1911, that the yield per ton milled was 21s. 10d., the cost 18s. 7d., and the profit 3s. 3d. The directors are awaiting a favourable opportunity of capitalizing the debt above-mentioned. P. Q. Treloar is manager. With regard to the deep levels now belonging to the New Steyn Estate, nothing is being done at

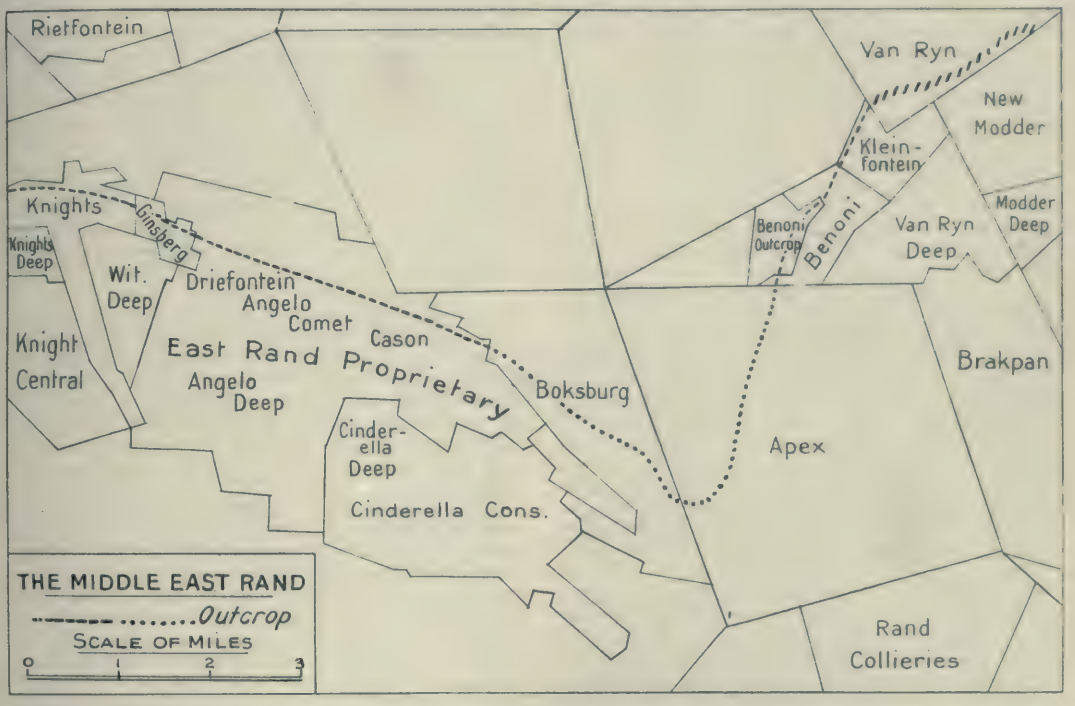



adopt the use of machine drills which are not as suitable as hand labour at this mine. The development work has also been hindered, and under the circumstances it has been thought best to postpone the contemplated enlargement of the mill.

**Roodepoort United.**—This company belongs to the Albu group and was originally formed in 1887. The property is in the middle west Rand. From time to time there have been many amalgamations and rearrangements of holdings, the last being in 1910 when part of the deep levels was handed to the New Steyn Estate. Milling started in 1888 with 20 stamps, and the equipment was gradually extended and improved until in 1909 an entirely new plant containing 100 heavy stamps and 5 tube-mills was erected. Dividends were first paid in 1894, but the amounts distributed have been comparatively small, owing to the difficulties of working. The report for the year 1911 shows that 441,894 tons was mined and, after the removal of 18% waste, 366,490 tons was sent to the mill, where 93,871 oz. gold was extracted by amalgamation and cyaniding. These figures compare with 303,587 tons and 66,993 oz. for 1910, but the output is still much below the capacity of the treatment plant, only present, as the times are not auspicious for the raising of the necessary capital.

**Cinderella Consolidated.**—In our issue of May 1910 we recorded the formation of this company to consolidate a group of Albu deep levels in the eastern Rand. The Cinderella Deep was the only producing property; this is a continuation, on the dip, of the Cason mine belonging to the East Rand Proprietary. Work has hitherto been hindered by the fact that there was only one shaft, a circumstance restricting, under Transvaal laws, the number of workers underground. In order to obtain a second outlet, a drift was started to connect with the Angelo Deep of the East Rand Proprietary, but this was discontinued owing to the suspension of work at the Angelo Deep. Subsequently a drift was made to connect with the Cason shaft of the East Rand Proprietary, and this was completed in November last. Owing to these circumstances, work at the Cinderella has been below its maximum. The report for the year 1911 shows that 70 of the 100 stamps and 3 tube-mills were running 331 days, crushing 192,341 tons of ore. The yield was 36,525 oz. by amalgamation and 25,984 oz. by cyanide, making a total of 62,509 oz., worth £264,606. The screen assay

was 6·93 dwt. and that of the tailing 0·45 dwt., so that the recovery was approximately 6½ dwt., or 27s. 6d. per ton milled. The working cost was £229,672 or 23s. 10d. per ton, leaving a profit of £34,934 or 3s. 8d. per ton. Other items of revenue raised the profit to £49,765, and as £100,871 was brought forward from the previous year, the total disposable balance was £150,636. Out of this, £21,770 was paid as debenture interest and £3572 as tax. Any distribution on the £1,159,450 issued share capital is postponed until the benefits of the double access to the surface are reflected by normal output. F. W. Girdler Brown, the manager, reports the ore reserve at 740,157 tons averaging 6·73 dwt. per ton. In addition he gives 191,451 tons as 'ore placed to suspense,' meaning that he estimates this amount of tonnage between the 3000 and 3620 ft. levels, so far not tested. Also 305,658 tons is returned as unpayable. Unfortunately he totals these three and describes them as actual ore reserves fully ready for stoping. The company's main shaft, now called the West shaft, is vertical for a distance of over 3000 ft. After striking the gold deposit, it follows the dip and has been sunk 992 ft. along it so far. Another shaft, the Central, has been commenced 5000 ft. to the east and is now down 1582 ft. It is intended eventually to sink a third, or East, shaft 6000 ft. further to the southeast.




**Brakpan.**—This company owns a second deep level in the far east Rand, below the Kleinfontein and Van Ryn Deep. It is controlled by the Consolidated Mines Selection Co.; W. L. Honnold is consulting engineer, and C. B. Brodigan is manager. Milling was commenced in May 1911. The mine has been developed from two vertical shafts, situated one below the other on the dip, cutting the deposit at 3100 ft. and 3700 ft. respectively, and connected by an incline. Fourteen levels have been opened up. The report now issued covers the year 1911 and shows that 249,041 tons was raised and 36,406 tons taken from the development dumps; after the removal of 14½% waste, 241,204 tons was sent to the mill. Of the battery of 160 stamps (2000 lb. each) 100 were in operation 200 days, and the recovery was 39,661 oz. by amalgamation and 39,492 oz. by cyanide, making a total of 79,153 oz. or 6·56 dwt. per ton milled. The revenue from the sale of gold was £331,828, or 27s. 6d. per ton, and the working expenses were £221,260, or 18s. 4d. per ton, leaving a profit of £110,977, or 9s. 2d. per ton. Of the profit, £100,000 has been placed to capital expenditure account, owing to the fact that the original estimate for the cost of opening and equipping the mine, altogether £1,135,700, has been exceeded. The reason why the whole of the stamps were not in use was the difficulty of obtaining the necessary underground labour force. In order to improve matters 106 machine-drills of various sizes have been put to work in the stopes, as the flat dip of the deposit favours this method of mining. During the year 10,675 ft of development was done, and on December 31 the reserve was estimated at 1,925,346 tons averaging 6⅞ dwt. Mr. Brodigan, in referring to these figures, states that, owing to the large size of the blocks into which the mine is divided, the estimate of quantity and content must be accepted intelligently.

**Meyer & Charlton.**—This mine, belonging to the Albu group, is situated in the central part of the Rand, between the City & Suburban and the Wolhuter. Milling started in 1888. In 1909 additional property was acquired on the dip, so extending the life of the company by eighteen years. During the months March, April, and May of 1911, hoisting and milling were suspended, while the main shaft was widened, new headgear erected, and the motive power changed from steam to electricity. The figures for 1911 therefore cover only nine months of actual output. During this time, the 75 stamps crushed 117,154 tons of ore

having an average assay-value of 8½ dwt. The yield by amalgamation was 18·735 oz., and by cyanide 25,940 oz. In addition 3996 oz. was recovered from accumulated slime. The total yield was 48,671 oz., worth £210,496, and the cost was £111,238, leaving a working profit of £99,258. From this has to be deducted £11,997, the expenses during the time the mill was closed, and £15,169 taxes. In addition £66,885 has been spent out of revenue on the improvements named, being the balance of expenditure not provided out of capital. As the year commenced with a balance in hand of £102,978, it has been possible to maintain the payment of dividends, £80,000 being distributed. On December 31 the ore reserve was calculated at 347,040 tons averaging 9·09 dwt., or 312,336 milling tons averaging 10 dwt. This was an increase of 70,000 tons during the year.

**New Goch.**—This mine on the outcrop in the central part of the Rand, though worked by various companies at different times, only arrived at the profit-earning stage in 1909. The control is now with the Albu group. The plant consists of 120 stamps and 4 tube-mills, the fourth having only recently been added. The report for the year 1911 shows that 484,393 tons of ore was raised, and after the rejection of 28½% waste, 346,862 tons was sent to the mill. The recovery was 58.587 oz. by amalgamation and 40,167 oz. by cyanide, making a total of 98,754 oz. worth £417,756, being 5·7 dwt. or 24s. 1d. per ton milled. During the previous year the recovery was 94,233 oz. from 338,618 tons milled. The working expenses were £291,352 or 16s. 9d. per ton milled, and the profit £126,403 or 7s. 4d. per ton. In 1910 the figures per ton milled were: cost 15s. 3d. and profit 8s. 3d. The increase in the cost is due to the larger amount of ore raised and the greater amount of waste removed. Out of the profit of £126,403, debenture interest took £9768, redemption of debentures £23,652, and taxes £10,871; £5807 was allocated to capital expenditure, and the dividends absorbed £68,750, being at the rate of 12½% as compared with 15% in 1910. E. H. Bulman, the manager, reports the reserve on December 31 at 894,632 tons averaging 5·17 dwt., being an increase of 152,944 tons and a decrease of 0·17 dwt. during the year. He also mentions the existence of 282,821 tons averaging 2·87 dwt. Special care is now being taken to leave sufficient pillars, so as to avoid a recurrence of caving.

**Aurora West.**—This mine is situated in the middle west Rand, on the outcrop, between the Bantjes and New Unified. It is an isolated member of the Albu group. The company was originally formed in 1889, and the finances are about to be reorganized for the third time. Operations were irregular before the war, and subsequently were not re-started until 1908, when a new 60-stamp mill was put into operation. The report for 1911 shows that 156,530 tons of ore was mined, and after the removal of 16% waste, 131,359 tons was sent to the mill. The yield from all sources was 37,103 oz., worth £156,943, or 23s. 10d. per ton milled. Other items of revenue brought the income to £158,003. The working cost was £127,537, and the profit £30,466, or 4s. 7d. per ton. Out of the profit, £1507 was paid as tax, and £11,354 as interest on the loan advanced by the General Mining & Finance Corporation, the parent company. J. P. Ward, the manager, reports the ore reserve at 345,578 tons averaging 5·85 dwt., and in addition 69,064 tons not fully developed, but estimated to contain 6·8 dwt. An additional 20 stamps have been added and the other 60 gradually overhauled.. As mentioned above, the finances are to be reorganized. For some time had it been intended to issue additional shares in order to repay the indebtedness to the parent company, but financial conditions have not been favourable. It is proposed now to reduce the 212,705 £1 shares to 10s. each, and to create 387,295 new shares of 10s., to be issued whenever possible, and the funds thus raised employed in liquidating the £164,241 debt.

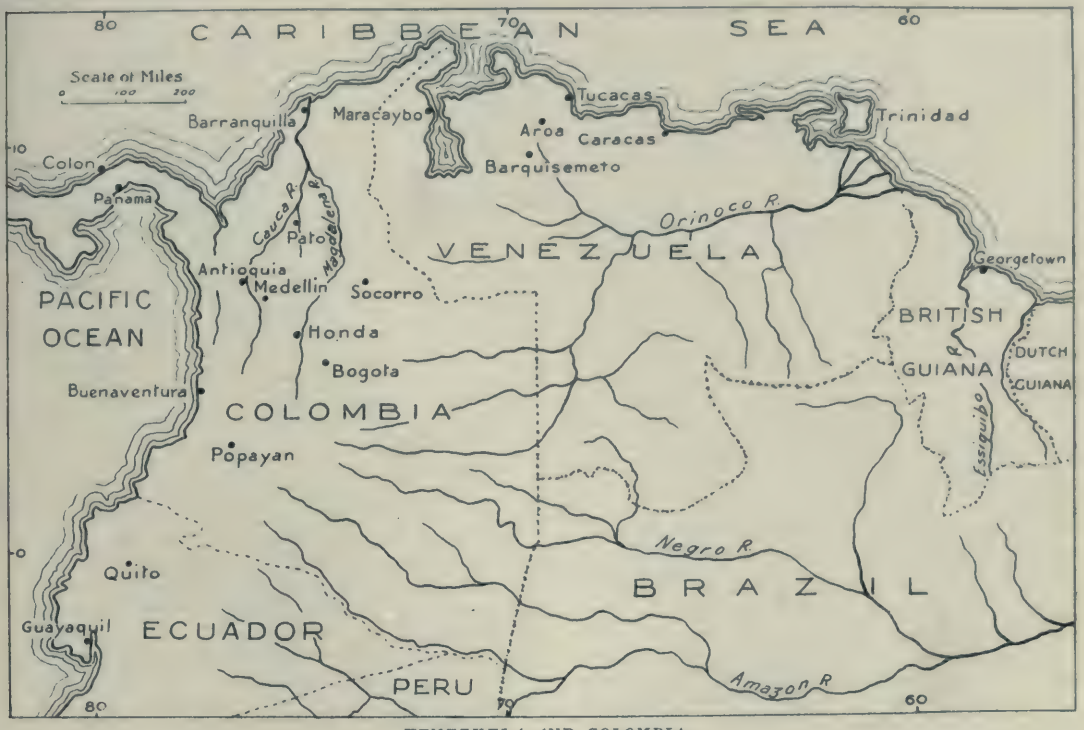
**New Lisbon Berlyn.**—This company was originally formed in 1885 to work gold mines in the Pilgrim's Rest district of the Transvaal. It has been reconstructed five times, the last time being in 1906 when the control passed into the hands of the Hamilton-Ehrlich group. E. T. McCarthy is consulting engineer and Charles Hunter has until the present month been the manager. In our issue of April last year we recorded that the company had arrived at a profit-earning period, owing to more development having been done and to the erection of a modern treatment plant. It will be remembered that the old Lisbon and Berlyn mines have been abandoned and that work is now centred on the Frankfort property, where there are two lodes, the Theta and Bevitt's. These are expected to contain large amounts of ore both oxidized and pyritic, but their development is slow and difficult. The report now issued covers the year ended September 30 last. During this time 18,059 tons of ore was treated yielding 942 oz. gold by amalgamation and 5051 oz. by cyaniding, a total of 5993 oz. worth £25,139, being an extraction of 85% of the content. The mining and development expenses were £21,284, administration expenses in South Africa and London £1945, and interest on loan £1476. There were other small items of income and expenditure, and the balance of profit was £933. During the year 4485 ft. of development work was done, as compared with 8115 ft. the year before, and the ore exposed thereby was estimated at 13,444 tons. The reserve at the end of September was 15,000 tons averaging 8·87 dwt. In addition, there is a large amount of pyritic ore that is not being treated at present. An option was recently taken on a new property at Granite Hill, eight miles to the north and near Glynn's, but the ore was found to be too patchy to be profitable and work has been suspended.

**Oroville Dredging.**—A company of this name was formed in 1905 in America to consolidate a number of gold-dredging companies operating in California. As a large proportion of the shares are held in England, a new company was registered in this country to acquire the shares in the American company and eventually to take over the direct management. As the exchange of shares is not complete, owing to some American holders declining the offer, the American company is still in existence and is responsible for the management. Another step has been the formation of the Pato Mines (Colombia) Limited, under English law, to acquire gold placers of that name in Colombia, South America, the working capital of which was supplied on loan by the American Oroville company. The report of the English Oroville company for the year ended September 30 last and that of the American Oroville company for the year ended July 31 last have now been published. As regards the operations in California, 4,433,262 cubic yards was dredged, yielding gold worth $462,286, at an expense of $261,832, leaving a profit of $200,454. The figures per cubic yard were: revenue 10·42 cents, cost 5·90 cents, and profit 4·25 cents. The yield per cubic yard was 0·5 cent less than the year before, and the cost was 1·81 cents greater. The figures relating to output and cost for the previous year were: cubic yards treated 5,661,612, yield $561,569, and profit $275,452. The

fall this year has been due partly to fewer dredges being in operation and partly to a decrease in the content in one section of the property. The profitable ground left to be treated is sufficient to last for five years. Repairs and improvements in the Oroville plant have been suspended until no further funds are wanted at Pato. As regards the latter property, the expenses have been greater than expected owing chiefly to the cost of the dam. Up to July 31 last, $534,129 had been advanced by the American Oroville company to the Pato company, and until the Pato property becomes a producer, no dividends can be paid to the shareholders in the American and English Oroville companies.

to December 31 last totalled 31,674 tons, averaging 9¾% copper, and yielding 2674 tons of metal. Since the turn of the year 4200 tons has been shipped. The directors contemplate a rearrangement of the capital and the raising of £75,000 working capital for the purpose of extending development work and providing metallurgical plant.

**Alluvial Tin Fields of Africa.**—This company has been formed for the purpose of acquiring and further developing an alluvial tin deposit known as the Kuils River tin mine, situated 16 miles east of Cape Town in the Stellenbosch district. The promoters are the group connected with the Kinta and other tin mines in the Federated Malay States, and F. Douglas Osborne,




*VENEZUELA AND COLOMBIA.*

**South American Copper.** — This company was formed in 1907 for the purpose of acquiring and reopening the Aroa group of copper mines situated on the Barquisimeto railway, 55 miles from the port of Tucacas, Venezuela. These mines have been known since the 16th century, and from 1882 to 1894 were worked by an English company, the Quebrada Railway, Land, and Copper Co. From 1887 to 1894, over half-a-million tons of ore averaging 8½% copper was mined. In the latter year the workings collapsed owing to inefficient provision for the stability of the overburden. At the time, the price of copper was exceptionally low, so that it was impossible to raise the necessary capital required to recover the mine. The present syndicate acquired the property, after it had been inspected by George Grant Francis, and the reopening was conducted under the management of W. J. C. Scrutton. The capital of the syndicate is £7500. The amount of cash spent in purchase and development has been £19,950; while £20,625 has been distributed in dividends. The shipments of ore

of Ipoh, Perak, is consulting engineer. The preliminary investigations were made by H. D. Day, one of the engineers on the staff of Osborne & Chappel, and subsequently Mr. Osborne proceeded to the spot. His report shows that in one block of 32½ acres, which has been carefully tested, the alluvium averages 18½ ft. in depth, and contains 972,400 cubic yards estimated to yield 4·6 lb. of cassiterite per cubic yard. Mr. Osborne is of opinion that the total net profit, with tin at £180 per ton and the concentrate assaying 72% metal, should be £210,180. There are other tracts adjoining that are promising but not as yet fully prospected. The method of working will be that usually employed in Australia and the East, that is to say, loosening the gravel by a monitor and elevating the wash by means of pumps to extraction plant on a floating barge, and subsequently returning the water to the storage reservoir. Mr. Osborne estimates that the cost of the dam and plant will be £15,775. This estimate is low, because some of the necessary machinery is already on the ground, having been pro-

vided by the Kuils River company, which did the original prospecting and development work. The capital of the new company is £100,000, of which £90,000 is now being issued; £40,000 in shares and £30,000 in cash goes to the vendors, and £20,000 will be provided as working capital. The whole of the 50,000 shares to be issued for cash have been underwritten.

**Rio Tinto.**—The report of the premier copper mine of Spain for 1911 shows a divisible profit of £1,093,939, which compares with £1,045,730 for 1910. The 5% preference shares receive £81,250 and the ordinary shares £984,375, being at the rate of 52½%, as compared with 50% in 1910 and 60% in 1909. The average price of copper was £56. 1s. 9d., as compared with £57. 3s. 2d. in 1910. The extra profit for 1911 was presumably due to the continued increase in the sale of ore for sulphur content. The amount of copper ore mined during the year was 2,185,605 tons averaging 2·144% copper, an increase of 38,840 tons; of this 649,215 tons was selected for shipment and 1,536,390 tons reserved for local treatment by smelting or leaching. The amount exported and invoiced for both copper and sulphur contents was 662,259 tons, as compared with 578,443 tons in 1910. In addition to the copper ore a large amount of raw ore was exported for sulphur content alone; the report states that the deliveries of sulphur ore, both that which had been leached and the raw ore, totalled 841,964 tons, as compared with 683,605 tons in 1910 and 569,604 tons in 1909. The total copper brought to market as metal and content in pyrite was 33,385 tons. The production of copper at the mines during the year was 21,880 tons, as compared with 22,790 tons in 1910 and 24,364 tons in 1909. The report mentions that the use of machine-drills is being extended, and that the rainfall during the past winter has been excessive, the operations being to some extent hindered by storms and floods.

**Seoul Mining.**—This is an American company owning the Suan gold-copper mine in the Hwang Hai province of Korea. H. Collbran is president and A. R. Weigall is manager and engineer. The property was formerly worked by the Korea Syndicate, an English company, but operations were not successful. The present company started milling in December 1909 with 20 stamps, which were increased to 40 at the end of 1910. The metallurgical problem presents several difficulties. For one thing the copper minerals slime so much that not more than 20% of the copper assay-value is being recovered in the concentration plant. Secondly, native bismuth occurs with the copper minerals and interferes with the amalgamation of the gold. Recently, however, the company has received some compensation with regard to the latter point, in that the English buyers of the concentrate pay something for the bismuth content. The report now issued covers the year 1911. During this time 70,229 short tons was crushed having an average assay-value of $9·30 gold and 1·03% copper (the dollars are United States currency). By amalgamation, bullion worth $436,364 was recovered, being 66·8% of the content, and 697 tons of concentrate was produced containing gold worth $80,217, copper realizing $22,826, and bismuth realizing $10,864. The recovery of copper was 18·4%, and by amalgamation and concentration the recovery of gold was 79·1%. The income during the year was $551,470, and the operating expenses $211,626, leaving a profit of $339,844. Out of this $31,771 was paid as royalty, rent, and tax, and $20,000 was allowed for depreciation of plant. Dividends absorbed $200,000, being at the rate of 50%. For 1910 the first distribution made by the company was $100,000. During 1911 the ore reserve was increased from 190,100 tons to 211,400 tons, and the continuity of both main orebodies was proved on the third level.

**Esperanza.**—This company was registered in London in October 1903 to acquire the majority of shares in the Esperanza Mining Company, a New Jersey corporation owning and operating the Esperanza gold mine at El Oro, Mexico. The reports of the English and American companies for 1911 are now published. During the year, 250,022 short tons of ore was raised from the mine and sent to the mill. The yield of gold was worth $1,675,611, or $6·17 per ton. The corresponding figures for 1910 were: tonnage 206,918, total yield $2,133,896, and yield per ton $9·37. The working cost was $4·43 per ton, as compared with $5·71 in 1910. The working profit for 1911 was $480,273, as compared with $858,669 in 1910. From the reports of Edwin S. Berry, the consulting engineer, and Charles Hoyle, the manager, it is seen that the development work during 1911 has been disappointing. The reserve on December 31 was estimated at 220,487 tons expected to yield a profit of $638,887, as compared with 404,100 tons and $1,408,618 a year ago. The San Carlos vein though showing good results to date is not sufficiently developed for an opinion as to its prospects to be given. The tailing dump is to be re-treated at an estimated profit of $440,000. There is in addition to the ore reserve a large amount of filling in the old workings in the upper levels that can be treated at a profit. The profits of the American company remitted to England were £85,000, and £78,788 has been distributed by the English company as dividend, being at the rate of 22½% less income tax.

# TRADE NOTES

*Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.*

**The Lilleshall Co.'s** bulletin on air compressors gives particulars describing and illustrating the Rogler-Hoerbiger Patent Valves which this firm have incorporated in their designs.

**The Hardinge Conical Mill Co.** have been given the decision in the United States Circuit Court of Appeals in their suit for infringement brought against the Abbé Engineering Works. This affirms the decision of the lower courts.

**Fraser & Chalmers** issue under date of March 1912 a new bulletin of 24 pages describing the units that are required in a complete cyanide plant, and the work they are called upon to perform. The various machines are well illustrated.

**The Denver Engineering Works** are continuing to improve the Richards Pulsator Classifier. Bulletin No. 1055, dated March 1, 1912, describes the 'inverted type.' The adjustments required have been greatly simplified; the machine is more sensitive and practically automatic.

**Deister Concentrators** are being exhibited at the testing works of Geo. T. Holloway in a building specially erected for this purpose. The two machines are standard full size and can be tested on a commercial scale. Crushing and other appliances for preparing ore are installed. Visitors will appreciate the workman-like manner in which the plant has been erected and the facilities given for examination.

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*Scientia non habet inimicum nisi ignorantem.*

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# STATISTICS

### Stocks of Copper in England and the Continent.
Reported by Henry R. Merton & Co.

| | Feb. 29. Tons | Mar. 30 Tons | April 30 Tons |
|---|---|---|---|
| In England | 37,056 | 35,732 | 34,686 |
| In France | 5,976 | 6,418 | 6,035 |
| Afloat from Chile | 2,675 | 2,325 | 2,050 |
| Afloat from Australia | 5,800 | 5,700 | 7,000 |
| Total | 51,507 | 50,175 | 49,771 |
| In Rotterdam | 3,600 | 3,300 | 2,750 |
| In Hamburg (estimated) | 7,900 | 7,600 | 7,371 |

### American Copper Producers' Association.
In Tons of 2,240 lb.

| | Production. | Deliveries | | | Stocks at end of month |
|---|---|---|---|---|---|
| | | Domestic | Foreign | Total | |
| October 1911 | 52,792 | 28,602 | 26,832 | 55,425 | 60,267 |
| November | 49,945 | 30,375 | 29,932 | 60,307 | 49,905 |
| December | 54,865 | 29,459 | 35,374 | 64,833 | 39,937 |
| Total, 1911 | 639,258 | 316,791 | 337,009 | 653,800 | — |
| January 1912 | 53,272 | 27,832 | 35,789 | 63,621 | 29,589 |
| February | 51,801 | 25,101 | 28,191 | 53,292 | 28,098 |
| March | 56,114 | 30,128 | 26,241 | 56,369 | 27,843 |
| April | 56,011 | 31,033 | 23,773 | 54,806 | 29,048 |

### Production of Gold in the Transvaal.

| | Rand | Elsewhere | Total | Value |
|---|---|---|---|---|
| | Oz. | Oz. | Oz. | £ |
| July 1911 | 679,881 | 29,377 | 709,258 | 3,012,738 |
| August | 682,405 | 31,002 | 713,407 | 3,030,360 |
| September | 669,773 | 30,852 | 700,625 | 2,976,065 |
| October | 677,923 | 30,721 | 708,644 | 3,010,130 |
| November | 291,466 | 28,267 | 719,729 | 3,057,213 |
| December | 680,782 | 29,126 | 709,908 | 3,015,499 |
| Totals, 1911 | 7,896,802 | 340,921 | 8,237,723 | 34,991,620 |
| January 1912 | 709,280 | 27,780 | 737,360 | 3,130,830 |
| February | 674,960 | 28,906 | 703,866 | 2,989,832 |
| March | *796,755 | 33,968 | *830,723 | *3,528,688 |
| April | 706,763 | 30,897 | 737,660 | 3,133,383 |

* Including 70,143 oz. worth £297,946 extinguished reserve.

### Cost and Profit on the Rand.

| Month. | Tons | Yield per ton | Costs per ton | Profit per ton | Total profit |
|---|---|---|---|---|---|
| | | s. d. | s. d. | s. d. | £ |
| July 1911 | 2,095,220 | 27 2 | 17 10 | 9 4 | 969,687 |
| August | 2,107,809 | 26 8 | 17 9 | 8 11 | 967,457 |
| September | 2,037,329 | 27 4 | 18 ½ | 9 4 | 952,665 |
| October | 2,083,900 | 27 0 | 18 0 | 9 1 | 948,278 |
| November | 2,089,387 | 27 6 | 18 3 | 9 3 | 965,729 |
| December | 2,030,439 | 27 11 | 18 4 | 9 7 | 967,897 |
| 1911 | 23,888,260 | 27 7 | 18 0 | 9 7 | 11,414,863 |
| January 1912 | 2,067,161 | 27 6 | 18 10 | 8 11 | 997,557 |
| February | 1,980,396 | 28 3 | 19 2 | 9 2 | 907,192 |
| March | 2,163,998 | 28 1 | 18 11 | 9 0 | 1,204,764 |

### Natives Employed in the Transvaal Mines.

| | Gold mines | Coal mines | Diamond mines | Total |
|---|---|---|---|---|
| March 31, 1911 | 193,457 | 8,493 | 10,061 | 212,011 |
| April 30 | 194,328 | 8,511 | 10,272 | 213,111 |
| May 31 | 190,392 | 8,379 | 10,425 | 209,196 |
| June 30 | 186,940 | 8,212 | 10,597 | 205,749 |
| July 31 | 181,582 | 8,122 | 11,054 | 200,758 |
| August 31 | 179,810 | 8,182 | 11,292 | 199,284 |
| September 30 | 179,619 | 8,045 | 11,475 | 199,139 |
| October 31 | 179,194 | 8,078 | 11,319 | 198,591 |
| November 30 | 176,736 | 8,043 | 10,071 | 194,850 |
| December 31 | 178,282 | 8,053 | 8,914 | 195,249 |
| January 31, 1912 | 184,046 | 7,805 | 9,524 | 201,375 |
| February 29 | 190,320 | 7,922 | 10,789 | 209,301 |
| March 31 | 196,748 | 8,198 | 12,071 | 217,017 |
| April 30 | 197,937 | 8,364 | 13,785 | 220,086 |

### Gold Output of India.

| Year 1910 | Year 1911 | April 1912 | Year 1912 |
|---|---|---|---|
| £2,104,858 | £2,150,050 | £186,940 | £739,834 |

### Production of Gold in Rhodesia.

| Month. | 1908 | 1909 | 1910 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| January | 199,388 | 204,666 | 227,511 | 214,918 |
| February | 191,635 | 192,497 | 203,888 | 209,744 |
| March | 200,615 | 202,157 | 228,385 | 215,102 |
| April | 212,935 | 222,700 | 228,213 | — |
| May | 223,867 | 225,032 | 224,888 | — |
| June | 224,920 | 217,600 | 214,709 | — |
| July | 228,151 | 225,234 | 195,233 | — |
| August | 230,792 | 228,296 | 191,423 | — |
| September | 204,262 | 213,249 | 178,950 | — |
| October | 205,466 | 222,653 | 234,928 | — |
| November | 196,668 | 236,307 | 240,573 | — |
| December | 217,316 | 233,397 | 199,500 | — |
| Totals | 2,526,007 | 2,623,788 | 2,568,201 | — |

### Production of Gold in West Africa.

| Month. | 1910 | | 1911 | | 1912 | |
|---|---|---|---|---|---|---|
| | Oz. | Value | Oz. | Value | Oz. | Value |
| | | £ | | £ | | £ |
| January | 17,357 | 70,699 | 15,903 | 66,107 | 26,098 | 107,262 |
| February | 16,976 | 68,469 | 15,179 | 63,081 | 25,009 | 102,270 |
| March | 17,627 | 71,954 | 16,387 | 67,673 | 27,228 | 111,376 |
| April | 16,363 | 67,069 | 17,237 | 70,880 | — | — |
| May | 16,590 | 68,355 | 24,427 | 96,409 | — | — |
| June | 17,194 | 70,988 | 22,555 | 92,174 | — | — |
| July | 15,564 | 58,551 | 22,510 | 91,955 | — | — |
| August | 13,921 | 57,713 | 25,385 | 103,753 | — | — |
| September | 11,497 | 47,746 | 26,717 | 109,039 | — | — |
| October | 13,341 | 55,046 | 26,826 | 109,503 | — | — |
| November | 14,021 | 57,658 | 24,289 | 99,299 | — | — |
| December | 15,042 | 61,737 | 24,369 | 99,569 | — | — |
| | 185,493 | 755,985 | 261,784 | 1,069 442 | — | — |

### Production of Gold in Western Australia.

| Month. | Export oz. | Mint oz. | Total oz. | Total value |
|---|---|---|---|---|
| | | | | £ |
| Total, 1910 | 363,496 | 1,209,856 | 1,573,352 | 6,682,042 |
| Total, 1911 | 160,021 | 1,210,447 | 1,370,468 | 5,823,522 |
| January 1912 | 10,697 | 95,673 | 106,370 | 451,828 |
| February | 10,441 | 92,091 | 102,532 | 435,526 |
| March | 408 | 92,597 | 93,005 | 395,058 |
| April | 10,698 | 99,708 | 110,406 | 468,972 |

### Other Australasian Gold Production.

| | 1910 | 1911 | April 1912 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Queensland | 1,840,337 | 1,623,390 | 130,450 | 476,570 |
| New South Wales | 803,727 | 769,353 | 50,555 | 209,011 |
| New Zealand | 1,896,322 | 1,808,049 | 140,552 | 542,432 |
| Victoria | 2,422,700 | 2,138,000 | 133,752 | 596,952 |

### Sale of Tin Concentrate at Redruth Ticketings.

| | Tons | Value | Average |
|---|---|---|---|
| Year 1911 | 6151¼ | £702,599 | £114 4 5 |
| Jan. and Feb. 1912 | 973 | £114,273 | — |
| March 4, 1912 | 268¾ | £31,579 | £117 10 0 |
| March 18, | 230¾ | £27,002 | £117 0 4 |
| April 1 | 258½ | £30,529 | £118 2 0 |
| April 15 | 220 | £26,571 | £120 15 7 |
| April 29 | 261 | £33,162 | £127 1 2 |

### Exports of Tin and Ore from Straits and Bolivia.
Reported by A. Strauss & Co.

| | 1911 tons | Apl. 1912 tons | 1912 tons |
|---|---|---|---|
| Metal from Straits to Europe and America | 55,135 | 4,190 | 18,633 |
| Metallic Content from Bolivia to Europe | 22,577 | 1,515 | 6,247 |

# REVIEW OF MINING

INTRODUCTORY.—After the coal strike the market became buoyant, and even the mining departments exhibited signs of liveliness. These were erased by the gloom of the *Titanic* disaster, the depression being so great as to check transactions of every kind. When the emotional effect had passed, there was renewed activity, and at the time of writing the outlook is cheerful. A number of new issues has been made, and the public response in subscriptions, we understand, has been satisfactory to the underwriters. This is not surprising, considering the protracted period of stagnation, and the concurrent accumulation of capital. So far this year, the amount of capital invited for subscription has been less than it was last year. It is a notable coincidence that the wild gamble in Marconi shares, a feature of recent Stock Exchange settlements, should have synchronized with the prominence given to wireless telegraphy by an appalling maritime disaster. Apparently the speculation in the shares is as little under control as the operation of the instruments invented by Mr. Marconi.

The mining market continues to undergo fitful illumination by reason of Nigerian pyrotechnics. While the increase of speculation in this department was welcome as a sign of renewed public interest in mining ventures, it has been marked by several unsavoury incidents and by a recrudescence of the business immorality that kills legitimate industry. The Nigerian hippodrome exhibits many of the tricks that disgraced the Kaffir circus. Rhodesia has contributed her share of *opera bouffe* in the Bucks Reef incident, the shares of that company being aviated from a few shillings to 25s. on fairy tales that proved wholly fictitious; whereupon the shares vol-planed to 13s., and now merely represent a shattered enterprise. The people that are caught in these financial dust-storms deserve no sympathy, for such operations are not even distantly related to sane business. Rhodesia is suffering, and will continue to suffer, from the chicanery that has marked the financial transactions incidental to mining operations in that region. The London administration of many Rhodesian companies does not, and should not, inspire public confidence, and in that loss of reputation several prominent engineers participate. Rand shares give fitful signs of recovery, but a restoration to public favour is unlikely until the controlling houses have exhibited more protracted regard for the welfare of small shareholders. The Gold Coast is eclipsed, temporarily, by Nigeria. Siberian enterprises are doing well and that part of the world is destined to hold the increased attention of the mining speculator. At Broken Hill the ostents are good. In Mexico it is chaos, for the present. South America, and Peru in particular, is attracting the financially adventurous, for the railroads are giving access to a promising mineral region.

TRANSVAAL.—The March statistics were good, in every respect, especially in the most important item, total profit. This 'profit' would be more significant if accurately stated; only about 75% reaches the shareholder, the remainder is spent before the ultimate purpose of mining is fulfilled. The April figures are also good. As regards labour, the general position has improved. During March, the natives employed on gold mines increased by 6428, and in April the increase was 1189. This makes 197,937 as against 194,328 at the end of April, 1911. Recruiting operations are likely to become less important, the requisite supply being obtained by voluntary migration. This will save a good deal of money. However, we repeat the warning that, while the

supply may fluctuate favourably, the general labour conditions continue to be a menace to the prosperity of the mining industry. From a day-to-day speculative standpoint the recent improvement is important; from an investor's point of view it is of slight significance. Labour is scarce, expensive, and inefficient on the Rand; it will continue to be so.

The Way-Arbuckle cyanide plant as introduced at the Benoni mine has proved a complete failure, so complete indeed, that with no money at hand and little remaining credit, the company has not been able to proceed, but has been obliged to entertain proposals for amalgamation with its neighbour, the Apex.

The directors of the Durban Roodepoort have notified their decision, in consequence of the uncertainty of future returns, to declare dividends half-yearly, and not quarterly as heretofore. This mine has done well for its shareholders, having given them their capital 11 times over. Though the poorer Main Reef will now be the source of almost all the ore, the end of dividends is not yet, though in number and amount they will be less.

At the East Rand Proprietary the recovery has averaged 32s. 11d. per ton as against an average of 25s. 4·5d. for the whole of last year. Evidently waste is no longer mined and ore is being better selected. This is well; but it means, of course, a shortening of the life of the mine, as compared with the former estimate based on the treatment of a larger tonnage, including waste.

After the East Rand scandal comes the Randfontein Central. The chairman, Sir J. B. Robinson, seems to run the company as if it were his own private affair and as if shareholders were unnecessary evils. A complete dispersal of the staff has brought the management to a state of collapse. The two general managers, Messrs. A. D. Bacon and C. Baring Horwood, have been discharged; so has the chief mechanical engineer, Mr. David Gilmour, and the general secretary, Mr. James Crosby, besides the heads of various minor departments. Even Mr. J. W. S. Langerman, the representative, in the Union Parliament and elsewhere, of the Robinson interests, and the vice-chairman of the Randfontein Central, has resigned, his resignation going into effect on June 28. Mr. P. M. Duncan, the controller of expenditure, has left already. This is a pretty state of things. As against a number of capable and experienced men, Sir J. B. Robinson has appointed his brother-in-law, Mr. Colin Ferguson, as general manager. No more need be said at present. Meanwhile rumours are plentiful that things are as wrong in the mine itself as they are in the office.

Insiders speak confidently concerning the future of the Brakpan, and it is a fact that some of them have been buying the shares freely. The lowest level is said to be making a splendid showing, the banket averaging about 12 dwt. for a width of 60 inches, so that the output of the mine could be raised to an average of 28s. per ton. It is predicted that dividends will be at the rate of 30% this year and 50% next year. The only obstacle, it is claimed, to operating with the full complement of stamps and treating 60,000 tons monthly is the scarcity of labour. Even this may be obviated, for a time, by a mine so skilfully managed. However, we regard the labour problem as unsolved and a constant source of possible trouble to the mines of the Rand.

It is announced that the Union Government is to take steps to prevent avoidance of the graduated death duties by enforcing a tax of ¼% per annum on all dividend or interest-earning bearer scrip of companies operating in South Africa. This is most inopportune, coming at a time when Rand shares were just beginning to recover from a series of misfortunes.

The recent rise in Magadi Soda shares is due to the vigorous construction of a branch of the Uganda railway to the deposit in question. This is a Central Mining scheme. Our

San Francisco correspondent refers to a new Californian potash deposit now controlled by the Consolidated Gold Fields.

In the report of the General Mining & Finance Corporation it is stated that during 1911 the aggregate depreciation of the shares of Rand mining companies was £36,000,000. This is equivalent to the value of all the gold produced in that year. The total share valuation is reduced thereby to £75,000,000, another measure of the tremendous withering of capital during the 12 months.

RHODESIA.—Speculation in this department is insignificant. No general public interest is likely for the present, but when the Shamva, Cam & Motor, and Falcon mines approach the productive stage, it is probable that an effort will be made to excite another boom, Just now the drought is threatening to cripple milling operations. The failure of the crops may drive the natives to the mines and improve the labour supply, but this would be useless if the mills were shut-down.

The yearly report issued by the Globe & Phœnix and the chairman's speech at the annual meeting afford interesting reading. The most striking point disclosed is that though ore with a gold content of roughly £550,000 was mined during the year, the value of the gold in the ore reserve at the end of the year 1911, that is, £1,348,973, was approximately the same as it was a year before, though admittedly in the interval the ore developed had not been equal to that mined. It is evident, therefore, that in re-casting the ore reserve a higher metal content has been given to some of the blocks. What has been effected once must be considered as possible to occur again, though naturally the range of this possibility becomes less after the first application of this adjustment, and the reserve now can only be taken at its declared figure. This is all the more advisible in that the developments in the bottom of the mine are no longer extraordinary in their richness. The aggregate length of good ore exposed on the 18th level is stated so far to be 450 ft. divided over two lodes. The little work done on the 19th level has given disappointing results, though it may be that the main lode has yet to be disclosed at this depth. In view of these facts it becomes no easy matter to decide upon a new shaft to work the deep levels. Such a shaft without equipment would cost about £80,000 for sinking only. It has been started, but the decision to purchase full equipment will be deferred for a year.

In spite of the discouraging results recently set forth in the report of the Bucks Reef, the shares of the company advanced in one day in the middle of last month from 4s. 3d. to 12s. 3d. upon the reported recovery of the lode. A few days later the directors issued a statement that the developments were turning out badly and the shares relapsed. Though there seems little doubt that the developments in the mine itself are decidedly disappointing, there is a rumour that the shares appreciated because this company held an option over an adjoining property of some promise.

The Lonely Reef mine is reported to be making a good showing in depth, the lode being richer on the bottom levels. Between the 6th and 7th levels the average width is 51½ inches, and the average assay 37 dwt. per ton, as against the average of 22·6 dwt. for the 140,344 tons so far exposed. Presumably, however, the better ore has been removed from the upper workings.

It is stated at Brussels that the technical staff of the Tanganyika Concessions is to be changed and that Mr. Allan Gibb has already retired. A new metallurgist is in demand, and a second smelter is to be built. The Belgian commission first advocated the use of an electrical process, but now it has been decided to revert to ordinary blast-furnace practice. Friction is reported between the Belgian and British controllers. The Tanganyika enterprise still lacks a prime requisite, namely, the ad-

vice of a copper metallurgist of wide experience and tried ability. The existence of an orebody does not make a successful mining enterprise; it is necessary to treat the ore at a profit. Meanwhile, the annual meeting has been postponed, in order to give the Union Minière the chance to hold a prior meeting on May 10. Explanations are awaited with interest.

WEST AFRICA.—We make numerous references to Nigerian affairs, which quite overshadow Gold Coast mining. The short-lived boom has been followed by unpleasant disclosures. In our 'Discussion' department Mr. H. C. Hoover analyses the economics of such speculative debauches. Meanwhile the outlook is gloomy. The Rayfield appears to be the one really good thing in Nigerian tin mining; others may yet be found.

The results obtained by the Bisichi company are commented upon elsewhere. On April 20 a private cable concerning the Jemaa lode of the Anglo-Continental Company and reading as follows, was published in *The Financial Times*: "Have carefully examined into alleged lode which is only an elevated belt of greisen in which occur occasionally very small patches of rich tin ore. There are absolutely no indications of well defined lode and in my opinion deposit quite hopeless." This is different from the optimistic statements of the manager, Mr. J. Thompson, which statements sent the shares up to £8, and in our opinion it more nearly represents the position. The mining market also appears to be of similar opinion, as the shares are now about £2. So great has been the fall and so glaring the contumely covering both the property and the people concerned that those who once were loud in claiming to possess the extension of this alleged lode now find it necessary for their good name to issue disclaimers. Thus the Keffi Tin wishes it to be known it is quite distinct from the Anglo-Continental and that its property is several miles away from that owned by that company. Surely this is the unkindest cut of all. In the recently issued report of Mr. A. W. H. Anderson upon the property of the Benue company we have another case of verbal extravagance. The lodes, which in that report were stated to be clearly defined, cannot be seen by the newly arrived manager, Mr. M. A. Francis, who thought that there might probably be stockworks. Similarly where Mr. Anderson found alluvial deposits of fabulous richness, Mr. Francis advises bulk-testing. We have been given to understand that Mr. L. H. L. Huddart, till recently consulting engineer to this company, resigned as a protest to the action of the directors in publishing the report of Mr. Anderson without his consent. In the case of the Kano (Nigeria) Tin Areas definite information with regard to their Baba lode has been published. Six shafts have been sunk to shallow depths along a length of 1350 feet. In one of these, where a little driving had been done, samples of the lode would indicate that it contained about 100 lb. tin oxide per ton and that it had a width of 3 feet.

High assays from the alluvial deposits still filter through into the published statements. From the Juga it is reported that a new area of 210 acres has been pegged, and that the deposit averages 6 lb. per cubic yard. No idea of the number of cubic yards is given.

CANADA.—In our January issue we referred to the possibilities of mineral exploration in sub-arctic regions. Since then we have ascertained that such exploratory work is to be undertaken in several parts of Canada, some of it being due to the re-distribution of large tracts of the Canadian never-never land to the provinces of Quebec and Ontario. Ungava is a name much on the lips of prospectors in Toronto and Montreal. This region lies between Labrador and Hudson's Bay, almost due north from Quebec, to which it is shortly to be attached politically. During the early part of the past winter three prospectors brought news to St. John's, Newfoundland, of a gold discovery. They exhibited large nuggets in proof

of their story. Old geological maps show an area of Tertiary gravel in the northeastern part of Ungava, and it is there probably that this alluvial gold has been found. Companies were formed at Toronto, and elsewhere, to send expeditions in April. These have outfitted at St. John's and are proceeding up the Koksock river from the coast at Ungava bay; on leaving the river they will 'mush' or tramp for 100 miles inland. Another interesting, almost mythical, district is the Coppermine, between Bathurst bay and Herschel island, far away in northwestern Canada. The Ontario Government is sending an expedition northward to 'locate' the five-mile strip that is to be received by the Province from the Dominion. This part of the Hudson's Bay territory will undergo intelligent search, for the leader of the expedition is Mr. J. B. Tyrrell, well known to us as a geologist and mining engineer. We are aware that more than one syndicate has competent men in the field, and we shall not be surprised therefore if this summer the announcement is made of new and promising metal-mining districts in Northern Ontario, Ungava, the Hudson's Bay territory, or even those more distant regions that extend across the Arctic Circle.

Porcupine is quiet. The Dome mill is at work and the Hollinger is to start in June. The Vipond may be ready even sooner. Then there will be (with the McIntyre and Little Pet) 125 stamps available, or enough milling capacity to test the resources of the district. The Swastika, in the adjoining district, is to erect a 10-stamp mill.

AUSTRALASIA. — A new gold discovery is announced in the Oaks Rush district, 15 miles west of Kidston, in Queensland. Rich ore has been found in an extensive outcrop. Mount Elliott shares have risen on the news of a find on the 5th level, the lode consisting of 8 ft. of 13% copper ore.

Development on the 10th level of the Waihi continues disappointing. It is proposed to test the lode at greater depth. The company has ample funds for the purpose.

Working costs at the Sons of Gwalia, now that this mine has reached a depth of 2700 ft. on the incline, have, it is stated, increased with depth, having averaged 17s. in 1911 against 16s. in 1910. The West Australian Department of Mines shows a similar increase. Thus the average for 1908 was 19s. 3d., for 1909 it was 19s. 11½d., for 1910, 20s. 1d., and for 1911 it will be still higher. The most recent developments in the bottom, contrary to rumour, are decidedly good, being above the average in the mine to-day.

The Ivanhoe report furnishes further testimony to the impoverishment in depth that characterizes the deep mines of Kalgoorlie. The check-sampling of the ore reserve in the Ivanhoe exhibits a decline of 2s. 10d. per ton. The manager, Mr. Nicolson, has recommended, in consideration of recent results in stoping which have caused the bullion reserve to be drawn upon, that the monthly rate of profit should be reduced to about £16,000. Thus the inevitable has not been long deferred.

MEXICO.—We deal elsewhere with the conditions in this country. It is announced that a bond issue of 20,000,000 pesos is to be made, for the purpose of increasing the standing army to 60,000 men. At present all industry is paralysed by the failure of the Government to check lawlessness.

The Esperanza shareholders got a frank statement of the position. It is probable that Mr. H. A. Titcomb will be appointed consulting engineer.

The Consolidated Gold Fields is reported to have made a coup in America. It is probable that this refers to the International Petroleum Co., which has 'brought in' a well, in the Tampico oilfield, Mexico. We understand also that its Yukon holdings are promising, that the potash deposit in California is a valuable asset, and that Mr. J. H. Hammond is not now a member of the American advisory commit-

tee, which consists of Mr. H. H. Webb and Baron de Ropp.

SIBERIA.—We refer elsewhere to the Lena affair. Work at the mines has been resumed. On April 26 a force of 1009 men was at work, and on April 30 the number had increased to 2000. An inquiry is to be made by the Russian Government into all the circumstances.

The Anglo-Siberian Company has gone into voluntary liquidation, the assets being placed at 32s. 6d. per share. Its successor is the Russo-Asiatic Corporation, with a capital of £300,000, of which £200,000 will go to the Anglo-Siberian Company and the remainder to three Russian banks, namely, the Russo-Asiatic Bank, the Banque de Commerce Privée, and the Siberian Bank. The board has been re-organized and now consists of Messrs. C. T. Cater-Scott, of the London County & Westminster Bank, chairman, H. C. Hoover, deputy chairman, R. Gilman Brown, who is also consulting engineer, Leslie Urquhart, managing director, J. B. Reynolds, Alexis Poutiloff, the president of the Russo-Asiatic Bank, and Alexis Davidoff, president of the Banque de Commerce Privée. The company starts with a clean balance-sheet, all its capital being paid up in cash, with no loot for the promoters. The shares are quoted at 30% premium, mainly on the reputation of those constituting the board of directors.

The Pioneer Company of Siberia has acquired, by location, 100,000 acres of gold-bearing alluvium suitable for dredging. So far, only 2,000,000 cubic yards has been sampled; this carries 1s. per cubic yard and forms a small part of a large tract of 11,000 acres, which it is proposed to test forthwith. This property is called the Somnine and is situated in the valley of the Amgun river, 75 miles west of Nikolaievsk.

Among recent developments in Anglo-Russian enterprise none is more important than the authorization or official permission given to the Orsk Goldfields to operate within the prohibited coastal zone in the Primorsk region. This not only regularizes the work on the Kolchan placer but encourages the company, and other companies, to take part in the mineral exploitation of the coast province of Eastern Siberia.

VARIOUS.—Tin discoveries of some promise have been made in the Katanga district of the Congo. The locality is Kiambi, about 250 miles from Elisabethville. Alluvial deposits and pipes have been uncovered. The ore is easily crushed and can be hand-picked or jigged without trouble. No serious work has been done as yet, beyond clearing the bush. A party of 9 men is on its way from England, on behalf of the Belgian concessionaires.

The Famatina appears to have a future; after many and various troubles this copper mine in Argentina has been put into shape by Mr. A. W. Jenks, who is manager, under the general direction of Hooper, Speak & Co. A special metallurgical inspection by Mr. Walter G. Perkins has been followed by proposals for bringing the present plant to a profitable stage. An issue of £200,000 in debenture stock is to be made for this purpose.

The Pato dredging area, in Colombia, of the Oroville Dredging Co. is not likely to be productive until September. The hydro-electric plant is designed to supply power to at least six dredges; apparently it would have been wiser to put a temporary power-plant on a single dredge until more dredging ground had been proved. Only ground enough for one dredge is, we are informed, proved. In constructing the dam an error was made in supposing the bedrock to be water-tight; this is being remedied by the free use of cement.

On April 30 a train-load of coal was raised for the market from the Shakespeare colliery, of the Kent Collieries, Ltd., near Dover. The shaft, which was started 12 years ago, is 1275 feet deep. This enterprise, if successful, will mean much to industry in south-eastern England.

# EDITORIAL

THE REPORT that pricked the Anglo-Continental bubble was made by Mr. Huberto C. Wray, a mining engineer of wide experience and known probity. He went to Nigeria for a syndicate of experienced operators, who are to be commended for protecting the public by exposing a fallacy.

SHAREHOLDERS will be wise in withdrawing support from companies that fail to give intelligible information at reasonable intervals. The public will find it profitable to abstain from supporting enterprises that are conducted with secrecy. Honest and efficient management needs no mystery.

ALEXANDER HILL, one of the most esteemed members of the mining profession, died on April 24. His name was honourably connected for many years with the Tharsis and Rio Tinto mines, and since then with other famous copper mines in Western America. After he underwent a serious operation, at the close of 1910, his health was known to be precarious. Nevertheless, the sad news will come as a shock to many friends in America and Australia.

SANDOW'S COCOA scheme bears many points of resemblance to other humorous efforts of high finance. That the exponent of muscular development should be an authority on cocoa is no more preposterous than that an admiral, general, or proconsul should be a trustworthy judge of a mine or a reliable trustee for shareholders in a mining company. Great is the value of advertising, whether it be unconscious or deliberate. Sandow's advertising methods have made him known to the newspaper public and he is evidently turning his notoriety into cash. In this respect he resembles some members of the peerage.

AMONG those who went down in the *Titanic* were H. F. Julian, one of the leading experts in cyanidation, John Weir, formerly manager of the Highland Boy and other famous mines in Western America, Benjamin Guggenheim, a member of the family associated with the American Smelting & Refining Company, and Arthur G. McRae, smelter superintendent at the Spassky, in Siberia. With the exception of John Weir, who was a veteran, these were cut off in the midst of careers of distinct promise and usefulness. All of them met their fate like men.

GENERAL REGRET is expressed that Mr. S. Herbert Cox should have been compelled, by failing health, to resign the professorship of mining in the Royal School of Mines. He was appointed in 1905 and won the affection of successive classes of students. We learn with pleasure that the students propose to present him with a memento of his connection with the School, and we are asked to state that subscriptions can be sent to Mr. G. O. Canning, at the Royal School of Mines.

WILLIAM FRECHEVILLE has been appointed professor of mining in the Royal School of Mines, in succession to Mr. S. Herbert Cox, who is retiring on account of ill-health. Mr. Frecheville is one of two brothers both of whom have been long and honourably connected with important mining affairs, in the capacity of managing and consulting engineers. In selecting him for the appointment, the Advisory Committee recognized that the courses of teaching at the Royal School of Mines as organized by Professor Cox were still in process of change, due in part to the removal to new buildings and in part to the new position given to the School in the

completed scheme of the Imperial College of Science and Technology. Therefore it appeared advisable, to the Committee, to appoint a man who, apart from other qualifications, would be an energetic organizer and capable of confirming the work inaugurated by his predecessor. Mr. Frecheville, as a graduate of the School, will find himself in a congenial environment and will receive the cordial support of those who wish the School to achieve a place worthy of its high traditions. We wish him every success in his important work.

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BY a happy coincidence, Mr. William Frecheville, just chosen to occupy the chair of mining, is to be the chairman at the forthcoming annual dinner of old students of the Royal School of Mines. The dinner is to be on Wednesday, June 12, at the new Students' Union building at South Kensington. Tickets, costing 12s. 6d., can be obtained from the honorary secretary, Mr. Arthur C. Claudet, 6 Coleman Street, E.C.

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THE ANNUAL REPORTS of the leading finance companies—known as the big groups—operating in South Africa, all show how the depression of last year hurt their business, both by reducing the value of their share assets and by diminishing their profits from market operations. Most of them lay stress on the labour question, and acknowledge that the scarcity of natives crippled their operations. Indeed, last year was so unkind to the 'groups' that they have good reason to expect better treatment this year. In the Anglo-French Exploration report we read that "things have happened within the Rand mining industry itself which have seriously shaken public confidence." This is not only true, but worth saying. If the other groups will "read, mark, learn, and inwardly digest" this pathetic confession, it will be productive of that chastened conscience and clarified common-sense essential to good business.

AMATEUR SCIENTISTS have been much in evidence in connection with the loss of the *Titanic*. The statement was freely made that this great boat, though it was submerged beneath the surface of the ocean, would never reach the bottom, owing to the increasing pressure of the water, the depth of the Atlantic at the spot where she sank being two miles. We would remind such people that the rate of sinking of a body, simple or composite, is a function solely of its specific gravity and of the specific gravity of the liquid; that steel and water are practically incompressible, so that their specific gravities do not alter in any important way under the action of pressure; and, finally, that pressures transmitted through water upon a body are the same in all directions, so that the pressure of the superincumbent water upon a ship at a depth of a mile can have no counteracting effect upon its motion due to the difference in the specific gravities of it and the water. We may take it therefore that a ship, when once submerged and definitely commencing to sink, will proceed on its downward career with continuous acceleration until it reaches the bottom, however deep. But this is not all. The ship contains many watertight compartments full of air, and air is also trapped in many of the rooms and holds. The latter air being in contact with the water will be compressed as the ship sinks, and the specific gravity of the ship will be increased; thus its rate of sinking will become gradually greater. As for the watertight compartments, these will collapse from the outside pressure of the water when a depth is reached, depending on the strength and shape of the structure. At a depth of 1000 feet, the pressure of the water is about 450 pounds per square inch and for greater depths the pressure per square inch increases proportionately. It is certain, therefore, that at no great depth the compartments will collapse, with the result that the rate of descent will be still further increased. We may put

the problem in another way by asking the question: How are sedimentary deposits to be formed on the ocean's bed, of tiny fragments of rock and organic remains, if the pressure of the water at depth exerts a buoying influence upon them?

REFORMERS are so closely synonymous with bandits in Mexico at the present moment that it is hardly necessary to discriminate. These gentlemen on horseback propose to rectify the appreciation of gold by declaring a peso to be equal to a dollar, that is, by making 50% discount the equivalent of par. This would suit debtors generally.

### The Lena Strike.

Labour troubles at the mines of the Lena Goldfields in the Bodaibo district of Siberia, culminated in a strike early in April. On the 15th work was resumed under military protection. On the 17th the workmen collided with the troops, with the result that 107 of the former were killed on the spot and 84 died subsequently, besides 210 wounded. The officials took refuge in their club. Indignation has been expressed in Russia, and elsewhere, against both parties to the quarrel. The facts are difficult to ascertain. No less than 6600 men were on the pay-roll of the company last year, their average pay being 4s. per day. About 80% of the labour is unskilled. The workmen receive a proportion of the nuggets found in the gravel while at work, and appear to be undisciplined. Last year the Lena Goldfields produced £1,619,406 in gold from 881.001 cubic yards at a cost of 24·87 shillings per yard. This is a lavish production at a lavish expense. The mines are 1200 miles from the nearest railway and all roads are impassable at this time, when the snow is melting. The Government claims that the strike had a political character, a majority of the men's committee having been formerly sentenced for political offences. In the Duma on April 24 the Minister of the Interior stated that the mob attacked the company's buildings, prevented the operation of the steam tramway, and hindered those who were willing to work. He endorsed the action of the local authorities. A force of 110 soldiers faced a mob of 7000 persons, so he said. Warnings were given on a bugle and the men were commanded to disperse. They refused, and charged the troops. Three volleys were fired. It is a gruesome episode. Probably *vodka* explains equally the fury of the mob and the ferocity of the troops. It is claimed that the men intended to seize the arms of the troops and plunder the mines. This is not unlikely. They demanded an 8-hour day. On the other hand, the men have telegraphed to the Siberian deputies in the Duma asking for an investigation, claiming their demands to be reasonable, and the commander of the troops to have been overbearing. This also is likely. The company throughout has deprecated the use of unnecessary violence. It must be remembered that the English company is an association of shareholders having a large holding in the Russian company, which has complete control of the mining operations. The English company has never interfered with the management and leaves the entire responsibility to the Russian directorate. That is one reason why the cost of mining is so extravagantly high. No reason exists for placing any blame on the British directorate, which deeply regrets the unnecessary violence of the local authorities.

### Lode or Formation.

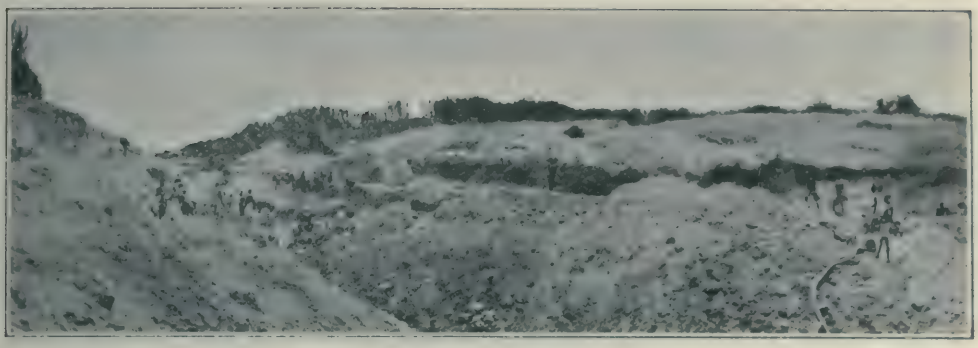
In one of those ingenuous letters that are written by shareholders to the editors of the financial daily papers, it is suggested that the expert who reported that the Jemaa was not a 'lode' may be right, and yet the Anglo-Continental may possess—in the Jemaa—a productive ore deposit, because the thing in question may be a 'formation,' and hence valuable. In support of this the correspondent refers to the story of the Great Boulder at

Kalgoorlie, and tells the story wrongly. It is true that the Hannan's excitement was based on wild-cats, and that the lode first found on the Boulder claim was a worthless quartz vein, but it is not true that an 'expert' condemned the Boulder deposit because it was not a true lode. The fact is that in prospecting the worthless quartz vein, the rich lode was found; this consisted of a width of schist containing both gold and calcite. This ore-channel or lode was not well defined and was called (by illiterate persons) a 'formation.' When first floated the Great Boulder enterprise was a swindle; it became a gold mine only by a rare accident. The morality of the transaction was not remedied by the subsequent discovery of a profitable lode on a claim where no ore was known to exist at the time of flotation. The Boulder is a true lode, a lode being something that leads a miner. Lode comes from the Anglo-Saxon *lædan*, to lead. A seam, thread, crevice, discolouration, or mineral arrangement may constitute a lode. It is a comprehensive term for the rock structure or appearance that gives the miner a clue to the presence and direction of ore. It would be as correct to say that a man had discovered a 'formation' as it would be to say that he had found a 'structure'; both are meaningless without a significant adjective. We speak of a geological formation or of a mineralogical structure. Colloquially in geology a 'formation' refers to rocks of a given period or a specific composition. A contractor in Colorado once drove—and carefully timbered—a cross-cut for many feet "in no formation." This was approximately true; it was a snow-drift. In a report issued a few days ago, we note that an educated engineer writes of a level extended "in no values." When engineers blunder in this way, it is pardonable if shareholders flounder among technical terms. Information on mining affairs will continue to be confusing so long as it is deemed of no consequence how it is expressed.

## Nigerian Affairs.

The Nigerian tin region has suffered from technical inexperience, it being a fact that most of the engineers sent thither are either lacking in alluvial experience of any kind or in that of tin alluvium in particular. Even the detection of tinstone in the field, as distinguished from garnet, ilmenite, tourmaline, and similar minerals, is not easy to those who are only versed in gold or silver mining. When it comes to the use of water in washing gravel, it is inevitable that many of the youngsters who have had a scanty experience of any kind, and none in this kind of mining, should make blunders. Companies have hired young fellows at small pay and then used their reports as if they were veterans to whom an adequate fee had been paid. Hence the conflicting statements. Unfortunately some of the honest and well-meaning among the so-called experts have played the game of the flamboyant promoter in apparent innocence, and as much harm has been done by them as by the few who knew better but were less scrupulous. The basis of any kind of successful mining operation is the advice of an experienced and honourable engineer; technical inexperience is apt to be as dangerous as moral obliquity; it is the duty of responsible directors to engage trustworthy men; if they cannot afford to pay for such advice, then they should not pose as being advised by specialists. What is a reasonable gamble to a small private syndicate may become a piece of rank deception on the part of a public mining company.

Our criticisms of the Nigerian mining business have been confirmed by later disclosures. The most regrettable incident has been the part played by the Consolidated Gold Fields. This company is supposed to stand for technical skill in mining and for a conscience in the business appertaining thereto. For this reason it has a large public following; it is not only a house of issue and a market operator, it is a reputable institution. It em-



*IN THE BAUCHI DISTRICT.*

*CALABASHING AFTER A STREAM HAS BEEN DIVERTED.*

*DRILLING IN A GRANITE OUTCROP, IN NORTHERN NIGERIA.*

erges from the Anglo-Continental affair with distinct loss of credit. Early in April it was stated in the financial Press that the Gold Fields had taken an option on 10,000 shares at £5, with a view to exercising that option should their expert report favourably on the Anglo-Continental property. Shortly thereafter it was announced (not by the company) that the option had been exercised, the inference being that their expert had reported favourably. He had not had time even to reach the mines. The public, accepting the leadership of the Gold Fields, bought Anglo-Continental shares. But without delay the Gold Fields got a call—so we are informed—on the shares at £6, and sold. The list of allottees proves either that they did not buy the shares in the first instance, despite the use made, freely and excitedly, of their name in that connection, or they sold before allotment, for they are registered as holding only 1500 reserve shares. The public did not know this and was fooled badly. The episode will tend further to undermine public confidence in the group system. Speculators, whether individuals or companies, have a perfect right to buy or sell, as suits them, but if a reputable company's dealings are freely used for market purposes, even to the point of mention in the financial Press, then it is 'up to them' to prevent their name being exploited for improper purposes. That we feel assured will be the view not of the public alone, but of other scrupulous operators.

In regard to the Benue, another Nigerian company whose affairs have come under criticism, it appears that Mr. L. H. L. Huddart resigned as consulting engineer because an optimistic report by Mr. A. W. H. Anderson, the manager, was issued without his concurrence. Since then a new consulting engineer and a new manager have been appointed. The latter, Mr. M.A. Francis, has cabled that "there is no justification for statements as to extraordinary value of new discovery." The shares, which rose to about £6 on Mr. Anderson's report, are now quoted at £3. On the face of it when a manager says that "this find is the greatest discovery made in any part of the world," it is high time to ask a consulting engineer whether such a statement is likely to be true. Mr. Huddart did right in resigning and he deserves the thanks of shareholders for protesting against the directors' unseemly haste to make the most of such reckless assertions. Since then Mr. Anderson has publicly reaffirmed his belief in the extraordinary richness of the lode, but this carries no weight because he gives no evidence in proof of that belief. An engineer should furnish facts, not unsubstantiated enthusiasm. Naturally those who sold their shares on the publication of Mr. Anderson's report will be grateful to the latter for the opportunity to realize handsomely, but the Nigerian department has suffered from this episode, and the mining profession in particular is entitled to dissociate itself from such vagaries.

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### Changes on the Rand.

Much ill-feeling exists among the technical men on the Rand because the haste to make changes in the personnel of the staff of various companies appears to be prompted, in some cases, by considerations that will not bear analysis. The unrest due to undiscriminating appointments has impaired the efficiency of the men who are the king-pins of real mining on the Rand, as distinguished from the other operations in which mines are used as mere counters for gambling. Those in financial control have shown curious reversals of policy. Not many years ago the American engineer was dominant; from California and Colorado came a number of capable men, and a number of 'false alarms' as well. Directors unfamiliar with mining were told that our own people were not practical enough and hurried to engage our friends from the Western States. They went to extremes. A few of the best

men in the profession were engaged, and many second-raters, all on big salaries. Subsequently several of the latter made blunders, the American lost his pre-eminence, it became necessary to introduce new blood. Somebody had the brilliant idea that a coal-mining expert was adapted to the exploitation of ore deposits that had the uniformity of a coal seam. The geology and the policy were alike fallacious. That epoch came to an end, in its turn. Then the yield of the ore declined, the effort to get tonnage regardless of profit was recognized as the last word of amateur administration, the managers who had striven for statistics instead of dividends were dismissed, and the industry having passed through many vicissitudes appeared about to emerge on a plane of penitent common-sense. However, when things began to go wrong and directors had to face the music, they thought it better to change managers than to lose their own seats at the council-table. The supine shareholder acquiesced in the re-election of a blundering chairman or a market-gambling board of directors, and accepted the vicarious sacrifice of a manager who may have been tied hand-and-foot by privileged speculators posing as trustees. Moreover, it is a part of the inherent contrariness of things that the idea of paying lower salaries and employing cheaper men should have become rampant just when the consolidation era began, when big mines were amalgamated with other big mines into huge heterogeneous units requiring the skill and energy of a superman in order properly to direct the vast and complex operations resulting. By this time the strong technical men had resigned or had been dismissed, and about the same time the leading operators had gone into politics to such an extent as to lessen their ability to attend to the administration of the mines. Blunders were made, and fiascos ensued. Shareholders protested. To placate public sentiment this or that manager was given a long holiday. Other changes were made, and not all of them with singleness of worthy purpose. Hence the position at Johannesburg today is weakened not only by the continued menace of labour scarcity and inefficiency, not only by the impoverishment of ore in depth, but by widespread uneasiness and loss of confidence among the very men to whom, more than to any board of directors, the shareholder must look for his dividends. There is no surer way of diminishing the efficiency of service than to render employment precarious.

## Conditions in Mexico.

The exodus of engineers from Mexico testifies to the belief that mining operations in that country are likely to suffer interference for some time to come. We have had an opportunity of discussing the subject with many of those who have been eye-witnesses of misgovernment, and we regret to find ample reason for grave anxiety. Political revolutions are not necessarily objectionable, some of them are inevitable, and, like a surgical operation, they minister to the future health of a country. In Mexico at this time, however, it is not a revolution, but a complete failure of government that confronts the mining operator. Francisco Madero last year was at the head of a genuine uprising of the people, driven to extremes by the corrupt despotism of the Diaz regime. That revolution was a success; Diaz fled; and in due course Madero was 'elected' President. In a country accustomed to liberal government, this change would have been followed by an interval of quiet, giving the new administration a reasonable chance to fulfil the promises on which it had risen to power; but the people of Mexico are not habituated to gentle and considerate government, they found Madero weak, they were impatient of his slow measures of reform, they refused him the support without which no government can exist usefully. It is true the more thoughtful citizens, anxious for peace, were willing to sup-

port the new order of things, but such support is ineffective in a half-civilized community unless backed by an army. Madero had no standing army, only a small gendarmerie, the *rurales*, a rough and efficient police, but wholly inadequate to hold in check a vast region in whose every corner the lawless and the disgruntled had learned to use revolution as a cloak for rapine. Some of Madero's officers were banditti posing as reformers: when Diaz was deposed they expected to be repaid for their services to the people's cause; whether they got it or did not, they hastened to begin an insurrection on their own account, claiming that Madero had failed to carry out his promises of reward and reform. With this excuse Zapata ravaged one part of Mexico, Salgado pillaged another, and Orozco terrorized a third. Madero had no sufficient army to extinguish these outbreaks, and the people generally were too pusillanimous to assert their opposition to guerilla warfare. The revolution of 1910-1911 had bred a general disregard for authority, each local governor or magistrate found himself attacked by those whom he had offended, every rowdy called himself an *insurrecto* and started to hold-up the supine law-abiding inhabitants. At the present time any ruffian has but to steal a horse and a gun to become a revolutionary; he then holds-up the first wayfarer he meets on the road, robs him, and thus secures sufficient funds to organize a band of roving marauders. They visit a mine, demand guns, ammunition, horses, food, whisky, or money, as suits them. The defenceless manager of the property buys safety by complying with the demands of the bandits, and, within a few days, finds himself requisitioned by federal troops, no better in appearance, manner, or greed. One party seems as bad as the other, and the fact that there are two makes it so much worse. An attempt at defence would mean isolation from food and other supplies, together with a disregard of such remnants of law as survive. Hence mining operations cease and the staff at the mine or mill is discharged until happier days come round. Of course, this disorder cannot last for ever. The civilized world, adjacent to Mexico, will not submit tamely to persistent anarchy, or to the continued destruction of capital invested under the promise of legal protection. Naturally the United States is loth to intervene; we are able to say that Mr. Taft informed a mine manager who went to see him that he, the President of the United States, would postpone armed intervention as long as it was at all possible and that he, the President, thought intervention could be avoided if no massacre of Americans occurred. Such an event may happen if any body of American residents were to arm themselves with a view to opposing the brigandage now rampant. Intervention is recognized by thoughtful observers as likely to prove a calamity to both the two countries concerned; it would mean a big war, and it would entail a serious check to the political and industrial development of the entire American continent. Besides that it would arouse, most legitimately, the acute jealousy and bitter emnity of all the Spanish-Indian countries south of the Rio Grande. In short, American intervention would seem to us, writing as friends of the United States, to be the very last resort to be used in settling the Mexican mess. We would rather appeal to the patriotic and intelligent Mexicans to save their country by supporting the Government, such as it is, in its effort to stamp out the brigandage that is now posing as political unrest. Mexico has among its population a sufficient number of men to whom patriotism is not a dead letter, and to whom self-interest will point a way of terminating a condition of affairs that threatens to bankrupt the country and all those in it. If Mexico is to be alternately at the mercy of greedy concessionaires under a Diaz, and of roving marauders under a Madero, if there is not enough manhood and intelligence to oppose both forms of rapacity, then it is time for

the country to be ruled by foreigners, but not till then. Steps have been taken to obtain the money required for the support of an army of 60,000 soldiers. We trust that this measure of public safety, too long delayed, will he hastened and that Mexico will shortly rejoin the ranks of civilization.

## Ivanhoe.

Those who were present at the Ivanhoe meeting must have appreciated the humour of the chairman's attitude, as expressed in a self-laudatory speech of obvious extravagance. This is not the first time that Mr. F. A. Govett has indicated his profound belief in himself. He has spoken of "my" mines and "my" staff, as if the Napoleonic idea were not dead but snoring. Apparently the Ivanhoe mine has been well managed and the shareholders might well express their thanks to the staff, including the chairman. But that, we are told by Mr. Govett, would be a misunderstanding of the facts. He does "not desire to detract in the smallest degree from the admirable work which has been done by Mr. Nicolson, by his engineer, Mr. Drage, by his able and enthusiastic staff." Not in the smallest degree; not at all, but "the point" he is "compelled to make is this: Who is responsible for the victory; is it Tommy in the ranks, is it the subaltern who gallantly leads them on, or is it the general who lays out the plan of battle? Of whom of these is it right to say, that *these* are the people to whom the victory is really due." The italics are not ours, but those of our esteemed contemporary, the *Mining World*, from whom we quote. Having asked these illuminating questions, it might be supposed that the innate modesty of the chairman would have allowed his hearers to supply the obvious answer. Not at all; evidently he thought their mental processes were slow, hence he adds: "It was my good fortune to be the general, and it was to my campaign, which I laid before you exactly 10 years ago, that our 10 years' success is due." Nobody present appears to have hastened to confirm Mr. Govett's impression in regard to the inner history of the Ivanhoe mine. Our own information is different. Mr. R. B. Nicolson was manager of the mine before Mr. Govett had anything to do with it; ten years ago Mr. Nicolson was a good mine superintendent and administrator, but he was not keen on metallurgical improvements; these were introduced by Mr. W. J. Loring for Bewick, Moreing & Co.; these improvements were introduced not on Mr. Govett's initiative, but despite him, and on the insistence of Mr. H. C. Hoover, who backed Mr. Loring. We recognize in Mr. Govett a director who brought to mining a sincerity of purpose and an honesty of performance that was a distinct gain to the mining industry of Western Australia, but we feel that the facts of the case warrant us in ridiculing his gasconade. Mr. Govett has set an example it will be well not to follow, if efficiency, not vainglory, is to be the aim of mine management.

## British Broken Hill.

From the speeches made at the British Broken Hill meeting, it would be obvious, if the fact were not already recognized, that the story of this mine constitutes another of those romances that touch the imagination of the adventurous. Eighteen years ago the British Broken Hill mine appeared to be on its last legs; the shares stood at half a crown, and there was talk of selling all available assets for 5s. per share, of 300,000 shares. Since then dividends to the amount of £412,500 have been paid and the shares are now quoted at 60 shillings. At the time of re-organization, in 1894, the working capital had been reduced to £40,000 and the mine was only opened to the second level. After the oxidized orebody had been exhausted the prosperity of the mine seemed at an end. The metals that rendered the ore valuable had fallen in price, the treatment of the complex sulphide ores was a prob-

lem then unsolved, and apparently insoluble, a drought was impending, and the labour position was gloomy. A turn for the better came with higher metal prices in 1905, the production being greatly increased by the solving of the zinc problem and the sale of tailing to the Zinc Corporation. This interval of prosperity proved brief, in 1907 the base metals declined in price, the grade of the ore was low, and the mill extraction was disappointing. The next two years were gloomy. It is true that in 1909 a new orebody was cut at the No. 8 level on Block 16, but further exploration appeared to indicate that it was unimportant. Conditions were so hopeless that the mine was then shut down. In June 1910 mining and milling were resumed, and early in 1911 exploratory operations were started once again. This was rendered possible by the issue of £30,000 in debentures. Good fortune waited on technical skill backed by financial courage. A magnificent orebody was found by cross-cutting and diamond-drilling. Bore-holes on the No. 6 level first cut into the ore, the maximum width being 153 feet. Since then it has been proved from the No. 3 to the No. 9 levels, and it will shortly be intersected on the 10th level. Not less than 2,000,000 tons of ore calculated to yield a profit of £1 per ton is said now to be available. For this fine accomplishment the directors and the staff deserve every credit. We note that at the annual meeting it was proposed by Mr. J. T. Lempriere that a bonus be given to the various officials, and that the directors be invited to resume the receipt of the full fees authorized. Shareholders should be as quick to thank the directors and staff for devotion to their interests as they should be courageous in criticism when a mining enterprise in badly administered. No men are more deserving of practical thanks from shareholders than are Mr. W. H. Woodhead, the managing director of the British Broken Hill mine, Mr. John Sampson, the manager, and Mr. C. Emery, his assistant. We hope that the reasonable expectations of prosperity at this mine will be amply fulfilled.

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### The Titanic Disaster.

At 11.40 p.m. on April 14, the *Titanic* struck an iceberg in Lat. 41° 44′ N., Long. 50° 24′ W., and was so damaged as to sink at 2.20 a.m. Of the 2340 persons on board, 1635 were lost, and 705 were saved in 20 boats, which were picked up by the *Carpathia* at 4 a.m. on the same morning. The night was clear, calm, and cold. Wireless messages had been received from other ships warning the captain of the ice danger. The ship was making her first voyage to New York, and had increased her speed up to 22 or 23 knots, which is equivalent to about 26 miles per hour. The look-out man was unprovided with any glasses or binocular and failed to see the iceberg until it was too late. When he gave a warning the ship was turned to port and struck the submerged portion of the ice, so that the bottom plates on her starboard side were torn and her forward compartments flooded. The berg was about 90 feet high, and after the collision the bow of the ship was covered with broken ice. She began to sink at the bow at once, but so slowly as to disarm anxiety on the part of the passengers, most of whom regarded her as 'unsinkable,' by reason of numerous watertight compartments. The captain and his officers, knowing that the *Titanic* had been vitally injured, ordered the boats to be lowered and commanded the men to give precedence to women and children. This was done in an orderly way, at first, but as the apprehension of peril spread there was increasing confusion, which, however, was kept in check. When all the women and children within call had been lowered into the lifeboats, some of the men took places in the other boats remaining. Many passengers and most of the crew did not appear on deck until after the last boat had gone. A general alarm was not sounded until some time after the collision, hence many died

in their berths. The firemen and engineers remained on duty, the former drawing the fires so as to prevent boiler explosions, and the latter 'standing by' as ordered by the captain. At about 2 a.m., the ship began to sink rapidly, the lights went out, explosions could be heard by those in the boats, now at a safe distance, and finally the stern stood high in the air before disappearing from sight. The night was starlit and the sea was calm as a pond; when the biggest ship ever built by man plunged to her grave in 2000 fathoms of water there arose the heart-rending cry of hundreds of victims. Of these a few survived, mostly strong brave swimmers who found means of support amid the wreckage until picked up by the *Titanic*'s boats or by those from the *Carpathia*, nearly two hours later.

The temperature of the water was 35°, this in itself affording warning of the vicinity of floating ice. Apparently the messages received from other ships were disregarded. It was important, from a business standpoint, that the *Titanic* should make a good run to New York. The captain was making his last voyage before retiring from the service. Everything indicates that an unnecessary risk was taken and that the disaster was caused thereby. A vessel of 46,000 tons rushing through water with the speed of a railroad train develops a momentum that is self-destructive if met by a resistant obstacle. At the time of collision the *Titanic* could not be stopped within the distance separating her from the iceberg; she could only be turned in her course, and to this fact unfortunately she owed her fatal injury. If the ice had been struck fairly her bows would have been battered, and only the foremost compartment, or compartments, would have been ripped open; as it was she was torn for a long distance in such a way as to destroy her buoyancy. The look-out should either have been blind or provided with a binocular; a direct collision might have saved her, for even an iceberg is not unyielding. The glancing blow of the submerged portion of the berg proved fatal. If this ice stood 90 feet above the water, it was about 600 feet thick, for the specific gravity of ice is such that seven times as much is below water as is seen above. On April 21 the *Pannonia* sent a marconigram to the *Cedric* stating that she had passed "several bergs 300 feet high" in Lat. 41° 14′ N, Long. 46° 15′ W. These may have been part of the field of ice that floated over the *Titanic*'s grave. If the bergs were as high as 300 feet, then the ice was fully 2000 feet thick, a thickness so enormous as to warrant scepticism.

The world stood aghast when the news of the disaster was flashed across the seven seas. Man's mastery over nature had been roughly questioned, an "unsinkable" ship had foundered, and with it had gone 1600 souls. The complexity of modern life had served only to increase the magnitude of the disaster, as in the case of the San Francisco earthquake-fire. An Indian village would have suffered but little from a slip in the earth's surface, if situated as far from it as San Francisco; and a dozen tramp steamers of small dimensions and slow speed would have endangered an equal number of passengers far less than the *Titanic*. The fact that the biggest and newest ship afloat was deemed immune from physical danger caused her to go to sea unprovided with boats sufficient to carry her passengers and crew.

From the physical facts of the catastrophe we turn with relief, but not without emotion, to the courageous conduct of the men on the *Titanic*, not only passengers. It is true that at the moment of the collision they did not realize their peril, and the first ladies to disembark were supposed to be facing unnecessary discomfort. But the bitter truth was soon surmised by the brave men who stood aside for the women and children. This may explain the heroism, but it does not detract from it. By the time it was known that the ship was sinking fast, the men had obtained a grip

on themselves, and faced the last summons with a quiet courage that has thrilled the world. They went to their last account unflinchingly, willingly yielding the chance of safety to those less able to struggle against the impending horror. The story of the *Titanic* is illumined for all time by a heroic afterglow.

## Costs in Nigeria.

This question is so important at the moment that no apology is needed for further reference to it. We take the case of the Bisichi company, which has lately issued its report and held its meeting. The directors report that the production of tin concentrate during the period under review was 171½ tons, of which 106 tons realized an average price of £138, the average assay being 73·32%. But if reference is made to the mining account it is seen that these 106 tons realized £11,803, or, roughly, £111 per ton, a difference of £27 per ton, which difference represents the cost and other charges of smelting the tin concentrate. It is a question as to whether these expenses should be considered part of the cost of production or not, but if not then they must be subtracted from the value of the metal in the concentrate. When a company markets its produce as tin concentrate and records the net proceeds from the sale of its concentrate then there is no call to enter the smelting as part of the cost of production. But when a company elects to consider that it sells the tin in its concentrate, then the smelting must be considered as part of the cost of production. The Bisichi company has chosen this latter course and the cost of production must include the above mentioned difference of £27. Referring again to the accounts of this company, it is seen that the cost of production of 171½ tons of tin concentrate, arrived at Liverpool, was £49 odd per ton, but that does not include London expenses, which in this case amount to £16 per ton, or to depreciation and other expenses which amount to about £7.5s. These figures, however, are to be found in the profit-and-loss account and they bring the total cost of production of concentrate to about £72. 10s. per ton. The chairman in his speech put this fairly to the shareholders when he stated that "basing a calculation on an output of 60 tons per month it is estimated that the reduction in standing charges would bring down the figure of gross cost to about £70 per ton." In the next sentence he completely spoiled the value of that statement by asserting that "the difference between this figure and the price realized when the metal was marketed would represent the net profit per ton." Naturally everyone will put upon these words the same significance as has been done by the directors in their report. They will see that during the period under review in that report 106 tons was realized at an average price of £138 per ton, that is the price of the tin contained in the ore, calculated on the price of the metal ruling during the period of sale. With the price at much the same high level now they will say that the profit will be somewhere about £138 −70=£68 per ton, whereas the actual profit will only result after £27 has been subtracted from this amount, which will leave the profit only about £40 per ton of tin concentrate. This figure is confirmed by the profit-and-loss account, where the net profit carried forward to the balance-sheet is given as £6490 from 171½ tons of concentrate, equivalent to about £38 per ton. It would appear from the chairman's speech that 65 tons included in the above total realized more than was allowed, so that the total profit would thereby be brought to a figure between £40 to £45 per ton. This is the result from one of the best mines in Northern Nigeria and from a concentrate well above the average in purity. The poorer mines with all the economy in working that the future may bring will never do better than this, though in the estimates the profit be put ever so high.

# PERSONAL

ARTHUR R. ANDREW has completed his examination of oilfields in New Zealand.

H. W. C. ANNABLE has moved his offices to 27 Old Jewry, E.C.

A. CHESTER BEATTY arrived in London from New York on May 1.

G. M. BENZIE is here from Rhodesia.

GEORGE H. BLAKEMORE is returning to Australia.

H. KENYON BURCH is remodelling the old Dominion concentrator in Arizona.

J. M. CALLOW has returned to Salt Lake from Arizona.

ROSCOE H. CHANNING is at Paris.

WILLIAM CROSLEY is here from Chihuahua, Mexico.

C. R. DAVIS has been appointed manager of the Brakpan mine.

H. S. DENNY has returned from Mexico.

ARTHUR DICKINSON has returned from Australia.

ROY ELLIOTT is home from the West Coast of Africa.

DONALD F. FOSTER is here from Mexico.

B. L. GARD'NER has gone to Spain for the Calamon Mining company.

W. P. HAMMON sailed for New York on May 5, returning to San Francisco.

W. CHARLES HAND has returned from Siberia.

THEODORE J. HOOVER is on his way back from Australia.

ALRED JAMES is back from the Rand.

CHARLES JANIN sailed on May 2 on his way to Nome, Alaska.

GEORGE JOHNSON is in London from Buluwayo.

H. EWER JONES is here from Rhodesia.

C. W. LEE has returned from Cobalt, Ontario.

LEGGETT & HELLMAN have moved their office to the Knickerbocker Trust Building, New York.

ARTHUR LLEWELLYN has returned from Egypt.

J. MALCOLM MACLAREN has returned to London after an absence of three years.

C. H. MACNUTT, whose second engagement at the Poderosa is expiring, will be in London at the end of May.

JAMES A. MACTEAR sailed for Peru on April 24.

E. T. MCCARTHY has joined the board of the Kent Collieries.

DRUMMOND MCGAVIN is on his way to Spitzbergen, by way of Tromsoe.

F. P. MENNELL is here from Rhodesia.

C. ALGERNON MOREING is due from Tunis on May 14.

HUGH PARK left London, returning to Cobalt, on April 24.

CYRIL E. PARSONS has been appointed consulting engineer to United Rhodesia, Ltd.

FRANK H. PROBERT continues to have an office at 314, Central Building, Los Angeles.

C. W. PURINGTON has been appointed chief engineer to the Pioneer Company of Siberia.

A. L. QUENEAU is in Belgium.

FRED S. REECE has returned from Colombia to New York.

J. H. RETALLACK has left for Arequipa, Peru.

HAROLD RICKARD, recently in Mexico, is in London.

J. H. RICKARD has returned from the Belgian Congo.

GEORGE M. ROBERTS has been elected senator for the new University of Western Australia as the representative of mining engineering.

STANLEY N. RODDA has opened an office at Melbourne as consulting engineer.

A. E. SEAL has returned from West Africa.

H. SHARPLEY has returned from New Zealand.

S. F. SHAW has been appointed superintendent of the Tiro General mine in Mexico.

O. J. STEINHART is in Norway.

C. H. STEWART is in Russia.

J. W. TEALE sailed on April 27 for New York, on his way to Mexico.

W. E. THORNE is in London.

R. GRYLLS THOMAS is prospecting at Ninkada, Nigeria.

C. F. TROUSDELL left on April 30 for Nigeria, in the service of the Bisichi company.

WILLIAM TRURAN has returned from North Brazil.

S. J. TRUSCOTT sailed for Sumatra on April 29.

W. H. WEED and F. H. PROBERT have dissolved partnership.

S. J. WEIS sailed for New York on May 5.

ALPHEUS WILLIAMS is here from Kimberley.

PHILIP WISEMAN passed through London on his return to Los Angeles.

# METAL MARKETS

## COPPER.

Average prices of cash standard copper:

| April 1912. | March 1912. | April 1911. |
|---|---|---|
| £70. 8s. 0d. | £66. 0s. 4d. | £54. 3s. 2d. |

The market has been less animated during April than in the previous three months, and prices closed at about the same level as at the beginning. While consumption remains at the same high rate, and the termination of the coal strike has again brought manufacturers into the market, there has been a good deal of quiet liquidation among speculators. The present range of prices must be regarded as reasonable, being unoppressive to the consumer and showing a fair return to the mines. If the market could be freed from speculative influences, it would probably be found that the increased output, which is now becoming apparent in the American returns, would on the whole counterbalance the increased demand for new electric enterprises. Unfortunately however for the future stability of the trade the speculative element after recent successes will be readily encouraged into fresh activity. American producers are well sold for a long time ahead and are consequently in an independent position. They are asking 16¼c. in America and £74 in Europe. American buying is reported to be more active, but shipments to Europe show a falling off, while warehouse deliveries here are heavy. Manufacturers generally are optimistic as to trade.

## TIN.

Average prices of cash standard tin:

| April 1912. | March 1912. | April 1911. |
|---|---|---|
| £200. 8s. 3d. | £192. 15s. 0d. | £193. 0s. 10d. |

In striking contrast to the copper market, tin has provided an excited rise in value. The termination of the coal strike and the reopening of the Welsh tinplate works brought consumers into the market for large quantities, and at the same time a continuance of the transfer of stocks from England to America has markedly lessened the supply of Straits. Prices rose gradually during the month, but just at the close shot up to £215 cash, and £210 three months. The rise will probably go further as stocks are small, and there appears to be a squeeze in warrants for May dates. The East is sending us restricted supplies, and their sales even at these high prices are only moderate. These considerations are discouraging any bear attacks on the market which the present level might have incited.

## LEAD.

Average prices of soft foreign lead:

| April 1912. | March 1912. | April 1911. |
|---|---|---|
| £16. 6s. 6d. | £15. 19s. 8d. | £12. 18s. 5d. |

A further advance in prices has been established, more by the scarcity of supplies already contracted for than by the fresh demands of consumers. The difficulties in transport from Spain have increased rather than diminished since the termination of the coal strike, and the supplies reaching London have been too small, in the absence of stocks at buyers' works, even for their lessened requirements. As shipping tonnage is freed, the Spanish accumulations coming forward will probably check the upward tendency.

## SPELTER.

Average prices of ordinary brands:

| April 1912. | March 1912. | April 1911. |
|---|---|---|
| £25. 8s. 10d. | £25. 19s. 10d. | £23. 13s. 8d. |

As was foretold in our April number prices have been gradually raised, the rush of buying since the convention reduced its demands having quite cleared the stocks in hand. Consequently producers have been constrained to advance prices once more, and at the same time to refuse to engage themselves ahead. Orders for galvanized iron and zinc sheets have been coming in freely.

## SILVER.

The silver market continues strong and the price has exceeded 28d. on several occasions. The buying has been chiefly for India, but there have also been important Continental orders, and some speculative purchases, while China, even at the advanced price, has sold only moderately.

## OTHER METALS AND MINERALS.

Prices quoted on May 9:

SILVER.—28d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£67 per ton.

NICKEL.—£170 per ton.

COBALT.—9s. 9d. per lb.

ANTIMONY.—£27 10s. per ton.

QUICKSILVER.—£8. 5s. per flask.

MANGANESE ORE.—8½d. to 11d. per unit (one per cent.)

IRON ORE.—Cumberland hematite 24s. 6d. per ton at mine. Spanish 21s. 0d. delivered in England.

PIG IRON.—Cleveland 54s. 6d. per ton. Hematite 70s. per ton.

WOLFRAM ORE—31s. per unit (1%).

# SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

## JOHANNESBURG.

**First-Aid** to the injured in course of their work on the mines is a question which should be now thoroughly considered by managers and heads of departments. Rule 277, Section 3, of the Mines, Works, and Machinery Regulations, 1911, is as follows: "On and after the 1st day of January, 1913, every mining official, on any mine employing not less than 500 persons, within 6 months after his appointment shall be required to be in possession of the certificate of an ambulance association recognized by the Minister, testifying that the holder has attended a course of first-aid, and is qualified to render first-aid to the injured, with special reference to mining accidents. For the purpose of this section mining officials shall be taken to mean the classes of persons shown on the following list, with any alteration of such list as the Government mining engineer may from time to time determine: Mine overseer, shift-boss, chief surveyor, mechanical engineer, electrical engineer, foreman smith, foreman carpenter, foreman fitter, chief electrician, battery manager, cyanide manager, compound manager, assistant superintendent or orderly." Whether more or less than 500 men are employed on any mine, it is important that as many persons as possible, whose work it is to be connected with the hazardous occupation of mining, more especially those employed underground, should know something of first-aid. It is imperative that the mining officials mentioned should all be competent to render first-aid, but in order that much needless suffering and possible loss of life, through ignorance, may be prevented, it is important that as many underground employees as possible should qualify to render first-aid. With the class of white labour which we have underground, it is impossible to expect all underground employees to understand something of first-aid, but by the adoption of as simple a first-aid course as possible, dealing only with such accidents as are most common underground, a great deal might be done. The usual St. John Ambulance Association course contains much matter which is of no practical use to underground employees. It should be made the duty of the mining officials, responsible for the underground departments, to see and encourage their men to attend first-aid instruction classes, and those men who are successful in passing the prescribed examination and obtaining the-first aid certificate should receive some mark of recognition from the mining company. If some such scheme were adopted, it would eventually be found

*NEW KLEINFONTEIN MILL AND CYANIDE PLANT.*

that men trained in first-aid would be scattered throughout the mines underground, and extra expenses, incurred by the mining companies in bringing about such a state of affairs, would be saved by the decreasing amounts paid for compensation.

**Underground Supervision.**—Old conservative methods, especially those in use in practical mining work underground, can only be improved gradually, as anything in the nature of a sudden change in the underground departments of the mines would militate against a fair trial being given to any possible scheme of improvement by the entirely practical men who still hold a strong position on the staffs of the mines. This is perhaps fortunate, as gradual progress is preferable to violent change, and is productive of better results. A new order of things is taking place in regard to underground work on the Rand. In the first place the personnel of the underground staffs is changing. The change is due to the incoming of the half-technical, half-practical men, who are gradually replacing the old type of entirely practical men, by obtaining such positions as underground managers, mine captains, and shift-bosses. The purely practical men have in the past held the upper hand entirely ; their day is now quickly passing, and at present there exists an intermediate stage, in which the underground staffs consist of technically trained men working with purely practical men in equal proportions. It is important that among the technically trained men, who are today on the underground staffs, the erroneous idea, which exists on most mines at present, of continual 'hustle,' should be eradicated before the best work can be obtained. The danger at the present moment is that technically trained men will fall into the habits to which they have been accustomed while going through their purely practical training on the field. A decided step must be taken in a new direction, and proper business methods must be applied to all underground work, in the same way as they are applied to surface work. All heads of departments on the mines have their own offices, except the head of the underground department. He certainly should have his own office, preferably next to the survey office, and employ clerks to keep complete costs and records of all work going on underground.

**Coal Mining Methods.**—The condition underground in the mines of the Rand, at the present time, resemble in many ways those of large collieries. It has been by a natural sequence of events, as the continuity of the gold-bearing conglomerates was ascertained, and their similarity in many respects to coal seams proved, that methods of mining which have been found successful in large collieries should gradually be introduced here. In the early days of Rand mining, the methods of working adopted were naturally typical of metal mining. The size of the properties worked was comparatively small, and the way was only then being felt, so that operations were on a small scale. Today, with the present knowledge of the conglomerate beds, and large deep-level properties and shortage of native labour, the mines are different propositions from the old outcrop mines. Mechanical ventilation has become essential to cool the underground workings and to improve health conditions. Mechanical haulage underground is slowly coming into vogue, and circular shafts are being sunk. All these are innovations on the Rand, but are the general rule in large collieries. With the gradual incoming of these schemes there will be eventually a change in the personnel of the technical staffs of the mines. Many men already having colliery experience have been brought out from England, to take up positions as consulting engineers and managers of mines for the various groups. The new systems coming into use underground on the Rand are steps in the right direction, but care must be taken that colliery methods of working are not pushed too far, as they require modification in many ways in order to suit local conditions.

**Ferreira.**—It is proposed to amalgamate the Ferreira Gold Mining Company, Ltd., with the Ferreira Deep, Ltd. A special general meeting of both companies is to be held on May 10, to confirm or otherwise the provisional agreement by which the Ferreira Deep, Ltd., takes over the Ferreira Gold mine for 70,000 shares worth about £266,000 at present. If the amalgamation resolutions are confirmed, the Ferreira company agrees to purchase 25,000 in the Ferreira Deep, Ltd., at a price not exceeding 76s. or £95,000. This, together with a cash distribution of 10s. per share to shareholders of Ferreira, will use up the cash which the Ferreira has at present in hand. The life of the Ferreira mine is rapidly drawing to a close, and with its working and possible absorption by the Ferreira Deep will pass away a mine, whose record is second to none in the history of mining. Since the commencement in 1887 until December 31, 1911 a working profit of about 4¾ millions has been made, on an original capital of £45,000, which was eventually increased to £95,000. The Ferreira was in existence before the days of over-capitalization, and has there-

fore not suffered in this respect. It is one of the mines which has made the name of the Rand, and caused the town of Johannesburg to be built where it is, close to the mine. During the past 23 years it has had practically only two managers, J. Harry Johns and Palmer Carter, which constitutes a record for the Rand, where changes in management take place much more often than once in about 11 years. From a technical point of view, the Ferreira has afforded most valuable experience in many ways, especially in regard to underground work, where, owing to the variation in dip of the gold-bearing conglomerates, from about 85° at the surface to about 30° in the lower levels, practically all methods of mining have to be adopted.

**Miners' Phthisis Compensation Bill.**—This bill as drafted by the Government provides for a Compensation Fund and Board. The Compensation Fund is to be contributed to by the mines at the rate of £6 for each rock-drill miner and £3 for every other white underground employee. One quarter of these amounts is to be paid by the men. Apparently the man earning 10s. per shift has to pay the same amount as the man earning 20s. per shift. This is unfair and it is a point which needs alteration. If the bill becomes law as it stands at present the mining industry will have to stand another heavy tax. The poorest mines, which are at present with difficulty making a profit, will have to close if further taxes are imposed by the Government, which in this case should, together with the mines and the men, contribute to the Compensation Fund by paying a third share. Interesting figures are to hand relating to the work of the present Miners' Phthisis Board; 492 cases for compensation, were dealt with between September, 1911, and February, 1912. The total amount distributed as compensation to the end of September was £47,067, to which must be added £2047 for administration expenses; the average cost per case was £95 13s. 4d., and the daily rate of application was 3·4. The number of cases still under consideration was 289. Thus the total number of applicants for compensation was 781, or about 7% of the whole of the underground employees of the mines on the Rand.

**Reserve Gold.**—It has been decided on many of the mines, chiefly these of the Rand Mines and Eckstein groups, to abolish the gold reserves, which it has been the custom in the past to keep in order to prevent undue fluctuations in the figures showing the monthly profits. This was done for market purposes. The abolition of gold reserves is indirectly the result of the East Rand Proprietary trouble. The idea is to give the public more confidence in the mines of the Rand, by publishing monthly returns, which will show exactly the actual results of the month's run. Another method, used in the past, of assisting the equalizing and averaging the results of good and bad months, so that on paper fairly constant profits might be shown, was by means of keeping working expenditure suspense accounts. It has now been decided that such accounts shall no longer be carried. The result will be that for the future, the mines adopting this new system, instead of showing fairly constant profits from month to month, will of necessity often show considerable variations, and explanations will have to be issued along with the monthly reports pointing out the reasons for the inevitable increases or decreases. The actual results obtained by working any mine will not be altered, and if the results were published every six months, for example, instead of every month, little difference would be seen between the published results, under the old system, and the figures showing the actual result of working under the new system. To the shareholder who has invested money in a mining proposition, with the idea of leaving it there and taking the dividends as they are declared, fluctuations in the declared monthly profits, which in future will be equivalent to the actual profits, will be of little concern; on the other hand the speculative shareholder may possibly be troubled by the jumpy state of the monthly profits. The only way left of regulating, more or less, the monthly profits, will be by arranging the clean-ups in the mill and cyanide works to give the amount of gold required for a certain profit. The condition of affairs in the mining world of the Rand are today different even from those existing a few years ago, when Louis Reyersbach suggested the abolition of monthly reports altogether, in favour of reports giving the results of the work done over longer periods. The suggestion was then unfavourably received. Today we have however a modification of the original idea coming into use. In the actual working of the mines, the effect of a little gold in hand has produced a feeling of some satisfaction, in the past, for those responsible for the work done, with the result that, with a little reserve to fall back on, repair work in shafts, etc., has been done in good time and not delayed on account of risking a drop in declared profits. Without any reserve gold in hand endless explanations will be forthcoming, when fluctuations in profits

occur. Explanations will become a habit, with the result that bad work will be explained away to those incompetent to judge. As far as the general public are concerned, it will be difficult for them to understand the reasons for fluctuating profits.

## TORONTO.

**Cobalt.**—Shipments of ore continue to show a fall, which however is fully compensated by the increase in consignments of bullion. The low-grade ore of the Kerr Lake and Crown Reserve, formerly treated by the Nova Scotia mill under contract, will be handled by the Northern Customs mill, which is increasing its capacity by the addition of 40 stamps, making a total of 120 stamps. The Crown Reserve is following a vein of silver into the Keewatin and extracting good ore. The Temiskaming in driving on the Gans property has opened up some lenses of high-grade ore which are yielding well. Its quarterly statement for the first three months of the year shows a production of 562,910 oz. of silver at a cost of 16¼c. per oz. The cash balance on hand was $484,219, of which $175,000 was due for payments on the North Dome property. The annual report of La Rose shows a production of 3,691,797 oz., of the net value of $1,810,470, at a cost of 19.20 cents per oz. The estimated ore reserves amounted to 4,256,861 oz. The combined surplus of the operating and holding companies was $1,551,420 after the payment of $599,450 in dividends. The Nipissing's output for the year approximated 5,200,000 oz., produced at a cost of less than 14c. per oz., and its reserves were estimated at $4,500,000 in value. During the first quarter of the current year the production was 1,179,470 oz. Generally speaking development in the northern territory was reassuring, while the results elsewhere were of an indifferent character. At 64 shaft, an exploration shaft is being put down to 450 ft., when cross-cutting will be done in the Keewatin to test the longevity of the mine. The Gould Consolidated has cut vein 146 of the Nipissing at the 100 ft. level. The Coniagas has paid its regular 6% quarterly dividend, but has suspended the 3% bonus usually given in addition. The McKinley-Darragh has made a good discovery in driving from a winze sunk 60 ft. below the 150 ft. level. where a vein 2 to 3 in. wide of 2,500 oz. ore has been cut.

**Porcupine.**—The formal opening of the Dome mill of 40 stamps took place on March 30, in the presence of a large crowd of visitors. A public celebration of the event was held under the auspices of the South Porcupine Board of Trade, which sent a great many invitations to mining men and capitalists at a distance. Both the mill and the mine were for the first time thrown open to the public. There were also public entertainments, processions, and bonfires, and the proceedings terminated with a banquet at which some noteworthy speeches were delivered. Ambrose Monell, president of the company, detailed briefly the history of the Dome, and recounted the formidable obstacles with which they had to contend. Speaking of the outlook for Porcupine, he said there was no reason to believe that the orebodies were contained only in a few properties, and he claimed that the development already carried out had accomplished more for the time consumed than had been the case with any other mining district known to him. Though the general tone of his speech was highly optimistic, he sounded a needed word of warning as to the danger of undertaking Porcupine mining enterprises on insufficient capital, which has been forcibly emphasized by the developments of the last few weeks. Charles W. Merrill, of San Francisco, the designer of the stamp-mill, said that after a study of Porcupine conditions he had come to the conclusion that there were few superior fields for economical extraction, as there was abundance of water, and labour of a high class, and he believed there were great posibilities for the development of large quantities of ore. The ore itself was one of the best in his experience. While the results of the Dome mill had not yet gone far enough to justify a positive prediction, he anticipated that they would be able to make a recovery of not less than 95%. Subsequent experience has fully sustained this estimate. The mill, according to the latest reports, has been working satisfactorily, with some temporary delays for adjustment, and gradually approaching its full capacity, and the recovery in some cases has been as high as 98%. The first shipment from the mine, consisting of gold bricks valued at approximately $25,000, was made on April 20.

The McIntyre 10-stamp mill is working steadily, handling an average of 65 tons per day. An addition of 20 stamps is being made as rapidly as possible, the west wing of the mill being enlarged to accommodate them. It is understood that 20 more stamps will be installed later in the season, making 50 in all, and should it be found expedient a cyaniding plant will be added. The Hollinger is experiencing delays in connection with the construction of its mill, as injunctions have been issued in the American courts against some of the manufacturers who

supply the machinery, for infringement of the patent laws. The completion of the mill is not expected before June. The No. 4 vein has been cut at the 200-ft. level, the assay-values being double the estimate made in the annual report of the ore in this vein. No. 2 vein also shows considerably higher gold contents than was then estimated. At the Dome Extension a large low-grade orebody has been encountered on the 100-ft. level, which is being developed by driving and cross-cutting. It is a banded schist and quartz deposit and apparently about 125 ft. wide. Driving has been commenced at the 200-ft. level to tap it at depth. The Dome Lake has sent a shipment of ore to be tested, and if the results are favourable will install a 10-stamp mill. The Crown Chartered in opening up an 18-ft. orebody at the 100-ft. level and is arranging to install a 10-stamp mill. The Preston East Dome is working the East Dome property, and has for some time been cross-cutting at the 100-ft. level to pick up the vein. Since the surrender of the Preston claim this is regarded as the last hope of the company. A number of companies have ceased operations, temporarily at least, for want of funds. The Pearl Lake, which has the deepest shaft in the district, being down 430 ft., has stopped work and made an assignment. The Rea found results disappointing at depth, as the deposits discovered between the 200-ft. and 300-ft. levels, which were very promising, petered out at 400-ft. The Standard has found no veins of economic importance, though some rich pockets were discovered, and is trying to raise funds for further development. These successive failures, together with the retirement of Bewick, Moreing & Co., and the failure from the outset of flotations which have never reached the development stage, have induced a general lack of confidence in mining investments on the part of the public, and for some time the stock market has been declining and apathetic.

*DOME, PORCUPINE.*

**Elk Lake and Gowganda.**—Constructional work on the Elk Lake branch of the Temiskaming and Northern Ontario Railway has been begun, and it is hoped to have the line ready for operation by Nov. 1. In anticipation of transportation facilities, closed mines are being reopened and preparations made to work new prospects. A number of prospectors and miners have gone thither from Porcupine. The Regal Co. of Elk Lake has purchased the plant of the Big Six and will begin operations immediately. The Donaldson and Hitchcock properties will also be worked. A recent shipment of 15 tons of high-grade ore from the Mann property, Gowganda, realized over $38,000.

**Northern Ontario.**—A party in charge of J. B. Tyrrell, of Toronto, will be sent by the Ontario Government to explore the northern area, formerly a portion of the territory of Keewatin, but recently acquired by the Province. They will probably start about the latter part of May and be absent for five months.

## CAMBORNE.

**Basset Mines.**—The publication of the report and accounts for 1911 has been for some reason delayed, and it is now two months beyond the date the annual meeting of the company is usually held. The result of last year's working should be a favourable one, but I refrain from forecasting the profit, as the actual figures will probably shortly be available. The results so far for the current year are the reverse of cheering, and as the company is the only one in Cornwall which makes public an estimate of the monthly working cost, I am able to present a reliable statement. Below I give a table showing the results of the first 16 weeks of the current year.

The reduction in the tonnage stamped for April was due to half the battery being idle, but the whole of the 176 Cornish stamps are now at work again. The redeeming feature of the situation is that the lode in the bottom of Pascoe's shaft, which is being sunk below the 310-fm. level, continues to be of an important character, and of quite twice the value of the ore being milled at present.

| 4 Weeks ending. | Ore Stamped Tons | Black Tin Sold Tons | Black Tin Sold Cwt. | Recovery per Ton Lb. | Average Price Secured | Value | Estimated Working Cost | Profit | Loss |
|---|---|---|---|---|---|---|---|---|---|
| Jan. 31 ..... | 3400 | 34 | 17 | 23 | 124 | 4315 | 4800 | | 485 |
| Feb. 28 ..... | 3505 | 40 | 3 | 26 | 126 | 5074 | 4900 | 174 | |
| Mar. 27 ..... | 3164 | 33 | 13 | 24 | 123 | 4136 | 5100 | | 964 |
| Apr. 24 ..... | 2658 | 32 | 3 | 27 | 123 | 3966 | 5100 | | 1184 |

**Levant.** — The accounts for the sixteen weeks ended April 18 last show a profit earned of £1083, as against £2430 and £1604 for the two previou s four-monthly periods, and this reduction is apparently due either to a fall in the copper and arsenic production, or to the fact that, in previous statements, the amounts credited for those minerals were unduly high, so that now the actual sales have been made, an adjustment, unfavourable to this account, had to be made. The sale of black tin was maintained, 118½ tons being produced, realizing £14,477, or an average of £122 per ton. In all, the receipts were £15,478, and the expenditure £14,395 including £690 for royalties. On the ore stamped, 8681 tons, the receipts were 35s. 8d. per ton, the working cost 33s. 2d., and the profit 2s. 6d. The operating cost is about normal, as the figure for 1911 is 33s. 1d., so it is evident that a fall in the price of tin of £10 per ton would convert profits into losses. With this fact to face, it is to be hoped that the shareholders will not divide any of the profit, but devote the whole of it to development. With the margin at present so fine, it is clearly the right policy to vigorously develop the property, in the hope of opening up better ground before the inevitable fall in the price of the chief product takes place. If the terms of the new lease have not yet been arranged, then the profit should be set aside as a reserve. It will be noticed that the royalties are 1s. 7d. per ton milled, or nearly 5% on the total receipts. It is practically impossible to intelligently follow the manager's report on the mine, because the values of the development points and stopes are still given in monetary units per fathom, while the width of the lode is always omitted.

**East Pool & Agar.**—The accounts of this mine are now presented quarterly, and for the three months ended March 31 last the profit earned amounted to the satisfactory figure of £2259. The development was no doubt on the usual limited scale, although the figure of footage is omitted on this occasion from the manager's report. However, it is satisfactory to note that development by rock-drills has at last been re-started, and I understand three drills are now in operation. It is to be hoped the present price of tin will be maintained and enable the mine to be vigorously developed on a scale which is justified by past results. Notice is given that a dividend is to be paid and much speculation is rife as to the amount the committee will recommend. In view of the reluctance of the large shareholders to pay calls, and of the neglected state of development, it is to be hoped the amount will be trivial. The adventurers' balance in hand is now £2606 or slightly over 8s. per share.

The following is an analysis af the receipts :

| | | | |
|---|---|---|---|
| Black tin sales ..... | 142 tons at £118·25 ... | £16,767 | |
| Less previously credited ... | 10 ,, ..... | 1,150 | |
| | 132 ,, | | £15,617 |
| Arsenic sales ..... | | | 568 |
| Wolfram ,, ..... | | | 1,805 |
| Copper ,, ..... | | | 60 |
| Sundries ..... | | | 297 |
| | | | £18,347 |
| Working cost ..... | | | 16,088 |
| Profit ..... | | | £2,259 |

On a tonnage milled of 15,072, the receipts figure at 24s. 4d., the working cost at 21s. 4d., and the profit at 3s. per ton milled. The average recovery of tin and wolfram was 21·9lb. per ton. The mines are now being drained solely by the powerful Cornish pumping engine at Agar, and the East Pool engine, after running continuously for 85 years, is being dismantled. It is the purpose of the management to clear East Pool shaft of the pitwork and put it in thorough repair, and finally make it the main hoisting shaft of the property. The developments in the lowest workings continue encouraging.

**St. Agnes Consolidated.**—The first report of this company is interesting reading and affords as good an example of exaggerated optimism as I have seen for many a year. It refers to the fact that the company's operations have been almost entirely confined to the development of its extensive mining area at St. Agnes, and says that "these operations have been effected with highly satisfactory results." I question whether anyone in Cornwall acquainted with the results actually attained would endorse this statement. It is common knowledge that the West Kitty Mines, in which the company holds a controlling interest, is in a tight corner, and without a good deal more capital cannot possibly be made a profitable proposition; the valuable lode found some months ago in the 80-fm. cross-cut south from Wheal Friendly cannot be properly developed until the shaft has been sunk another 25 fathoms. At East Blue Hills, the only other property to which much attention has been given, a fair amount of low-grade ore has been exposed, and most of it already milled. But it is hardly correct to call this ore "an excellent tin deposit," or to assert that, because the lode presumably enters the adjoining Blue Hills mine, "a large block of ground for extensive mining operations" is available. The St. Agnes district is notorious for the bunchiness of its ore, and any forecasts of the contents of undeveloped ground are the merest guesswork. No doubt the company owns properties of great possibilities, and the limited exploration so far undertaken has given encouraging results. This is really all that can be said. The capital of the company is £175,000 and of this £137,900 has been issued; with the exception of about £400 this has been allotted for the purchase of properties which at the time consisted solely of leases, and none of the properties had any equipment. Cash capital to the extent of £34,700 was obtained by the issue of 6% parcipitating debentures. The expenditure from the commencement of operations to December 31 last has been:

*OLD STAMPS AT THE BASSET MINE.*

| | | |
|---|---|---|
| On Plant, Shafts, and Buildings... ... ... | | £9373 |
| On Development and Establishment Expenses | £10,690 | |
| *Less* Tin Sales, Interest etc. ... ... | 2078 | |
| | | £8612 |
| On Investments in and Loans to West Kitty Mines ... ... ... ... ... | | £23,502 |
| On Preliminary Expenses and Commission on Placing Bonds ... ... ... ... | | £2364 |
| | | £43,851 |

'Sundry debtors and cash in hand' amount to £1728, while the 'Sundry Creditors' are £11,543, so it is evident that the company is in debt and will require additional capital to keep it going. Of the £10,690 placed to development account, apparently only £3174 was actually spent on the mines.

## MELBOURNE.

**Victoria State Coal Mine.**—A condition of chaos exists at the coal mine established by the Victorian Government to work the deposits at Powlett, in Gippsland. According to the Minister of Mines, who by the way is more up in the intricacies of the business of a country store than the affairs of a mine, the enterprise was to make Victoria independent of the Newcastle coal barons of the adjoining state of New South Wales. The State Railways were to be worked with Victorian coal and the public were in the end to obtain such cheap fuel as would enable industry to expand beyond recognition. This high-flown promise has been gradually toned down. In the first place, instead of the coal township becoming an abode of peace to the worker, it has become the centre of turmoil. Everything was done to make the life of the worker comfortable by a paternal government. Cottage homes were built and all the luxuries of modern civilization were supplied, together with the highest wages paid in the state to miners anywhere. Yet the worker was never satisfied. Demand followed demand. One complaint succeeded another. Now it was the miners, next the trammers, then the surface workers, or some other grade of labour. Then the output of the mine was not what was expected by many people and costs certainly were above the estimate. The quality of the coal was questioned and the quantity of slack made was far greater than should be the case. On top of it all the Railway Department has had to contract for the delivery of a large supply of coal from Newcastle. So people have begun to abandon the high hopes they entertained as to the tremendous benefits of the nationalizing of the coal industry of the state. If they only knew the whole of the facts, they would boot out the last advocates of such an idea. Unfortunately, the whole truth will never be known. The latest awakening comes through the agitation to abolish the dog watch, and owing to the decision of the general manager to reduce the hewing rate to 2s. 9d. per ton. A large portion of the staff has had to go and there are signs of mutiny on the part of those who remain over the shortening of hands. To the labour mind it is not a question of a fair day's work for a day's high pay, but to do as little work for as big a wage as a complacent Government would concede. The whole venture now appears to be on the way of being overhauled from top to bottom by the manager, and it is to be trusted that he will have the pluck, now he is under non-political control, to expel the socialist and the loafer. But it is too much to expect that he will secure such results as would have been got had he been working under private control.

**Metallurgical Progress.**—It cannot be said that mining is booming in Australia just now, yet the state of the industry is such as to occasion the greatest satisfaction to the investor. In a pioneer country like Australia, mining sets the track for the farmer and the citizen, so that it is of the utmost importance to the country that there shall be no set-back in the industry. What has helped us immensely has been the splendid price that metals have attained as the result of the improved state of trade. With the advance in the price of lead and silver and the high rate at which zinc has stood, the prosperity of Broken Hill has never been excelled. The value of the metals won is at the highest point reached, and it is gratifying to Australian conceit to know that this to a large extent arises from the skill that Australian metallurgists have attained in the flotation process. When Theodore J. Hoover was here investigating the advance made in that branch of science, he was intensely interested in the work done at Broken Hill under Mr. Hylton, the officer in charge of the Zinc Corporation. Apart from the experimental work done to ascertain the part that various agents such as alcohol and eucalyptus oil play in flotation process, an investigation was made to discover if it was possible to improve the Horwood process for handling complex ores of the type of those existing at the Tasmanian copper mine near Zeehan. These formations are of great size and no doubt their extent has been responsible for the attention given to them of late by German ore buyers and capitalists who have arrived at the conclusion that they could be treated by the Oker process. It was on these Rosebery ores that Mr. Horwood made his first tests, the results then secured being such as to inspire him with the greatest confidence as to the future of his process. In Tasmania on the other hand the feeling existed that the difficulty of maintaining an even temperature such as is required to achieve the best results with the Horwood process would tell against its success. Experimental work done while Mr. Hoover was here seems to indicate that general results with the process have been such as to inspire great confidence as to its future. Mr. Horwood, it may be explained, is the manager of the Broken Hill Proprietary mine, and the fact that the officials of the Zinc Corporation appear to be satisfied that he has hit upon a valuable invention must be accepted as independent tes-

timony that the problem of handling complex copper-lead-zinc ores such as exist at Rosebery in Tasmania and certain districts in Australia is a stage nearer solution and that without the intervention of outside metallurgical assistance.

**Mount Elliott and Hampden.**—Allusion has been made at different times to the prospect of an amalgamation between the Mount Elliott and the Hampden companies which own copper mines in the Cloncurry district in Northern Queensland. One of the shrewdest of our leaders in the mining world, William Orr, a pioneer at Broken Hill and Mount Lyell, and the first man in possession at the Hampden, set the ball rolling by urging the need for an amalgamation of copper interests in North Queensland. The concerns most vitally interested in such a proposal were the two companies already named; and their fusion as Mr. Orr foresaw would involve their securing the control of the big copper region now being developed in that part of the world. Although the two groups—one London and one Australian—that control the Mount Elliott and Hampden respectively are credited with working in accord there must be some rift in the lute, for the Australian people in the Hampden company have resisted amalgamation if it involves handing over the destiny of the two companies to London directors. Seeing that the fusion would have led to the Hampden being placed on the dividend list with the Mount Elliott, and that its finances would have been tremendously strengthened, the incident is not devoid of interest. In all probability, however, the hope existed that the terms as to control and as to finance would eventually be acceptable to the Mount Elliott people. This hope may have rested on the fact that the Mount Elliott mine was not opening up well at the bottom level, whereas in the Duchess mine of the Hampden company splendid ore continues to be developed. Of late however the situation has been changed, as the diamond-drill working from the bottom level of the Mount Elliott has proved 9 ft. of splendid sulphide ore. Then at the instance of W. H. Corbould, the general manager, the Mount Elliott company has secured at a cost of some £50,000 the Hampden South Consols mine which adjoins the Hampden and was retained by Mr. Orr when the Hampden flotation took place. This purchase made the Mount Elliott company largely independent of the Hampden, and with the strike of ore at the bottom level has meant a big jump in the price of shares, and an entire upset for the present of the chance of an amalgamation between the two companies. It may also mean that the Mount Elliott board will secure a dominating influence in North Queensland unless its members after all coalesce with the Hampden people or are content with the position they have already gained.

## SAN FRANCISCO.

**Potash salts** are attracting much attention in the United States just now, following the dispute between the German producers and American consumers last year, which served to call attention to the fact that we are dependent upon Germany for our supply. In consequence, Congress has made appropriations for the conducting of a search for supplies of potash in America by both the Bureau of Soils of the Department of Agriculture and the United States Geological Survey. The resulting competition between the Bureaus to be the first to get results has been trivial. To date the drilling in the bed of ancient Lake Lahonton (near Fallon), Nevada, has produced nothing though the work is not completed. A deposit of alunite has been discovered near Marysvale, Utah, but information as to how to produce potash salts from alunite on a commercial scale is still lacking. In the April number of *Cassier's Magazine*, G. E. Mitchell of the Geological Survey, contributes an article on the Leucite Hills of Wyoming, which, when panned down, proves disappointing. The Leucite Hills, in the Red Desert of south-central Wyoming, have been extensively studied and their characteristics are well known to geologists. The leucite-bearing rocks do indeed contain about 10% of $K_2O$, but unfortunately, so far as chemical technology is at present developed, it is of no more value as a source of potash salts than the $Al_2O_3$ of clays is a source of aluminium. But the worst flash in the pan was the recent announcement of Survey officials that they had discovered a lake, containing 4,000,000 to 10,000,000 tons $K_2O$ in solution, in the northwestern part of San Bernardino county, California, which would serve as a source of supply for the whole United States for 30 to 50 years. The facts of the matter are that while the lake does contain potash salts, of an unknown but presumably large amount, it is completely held by patent or location by the California Trona Co., which had thoroughly tested the deposits and discovered their nature some months before. The property is now held under mortgage by the Foreign Mines Development Co., an offshoot of the Consolidated Gold Fields of South Africa, and negotiations had been under way for the

sale of the property as a potash producer months before the Survey 'discovered' it. This potash apparently occurs in solution as KCl, associated with larger amounts of Na Cl and $Na_2C0_3$, and it is open to grave doubt whether the potash salts can here be produced at a profit. There are large quantities of potash in the United States and ultimately it is to be expected that means of utilizing some of the supplies will be found. The present agitation is calling forceful attention to the need of processes for treatment of the natural salts and to that extent is useful.

**The Mother Lode.**—Gold mining on the Mother Lode is experiencing the long-anticipated revival. While things are far from booming, significant changes have occurred in the last few months. The Utica, Kennedy, Argonaut, and other old producers are working along with the usual good results. The Argonaut, because of threatened litigation, is not paying dividends, but is accumulating a comfortable surplus that is invested in good interest-bearing bonds. Last year the South Eureka cut a bonanza in the foot-wall and its stockholders suddenly found an active market for their shares. Few sold, for the California mines are mainly owned by local men familiar with the business and of confortable income, so there has been remarkably little speculation in shares in proportion to the amount of gold produced. Indeed matters have settled down to a routine, and little attention is attached to discoveries that elsewhere would be widely heralded.

A few weeks ago the Melones, a mine famous for low-working costs and ore of low grade, discovered a body of high-grade ore that showed again that all the good things on the Mother Lode have not yet been found, but little attention was paid to the discovery. Recently arrangements have been made to re-open two famous old mines and in both cases the capital is being supplied by local people already familiar with the industry. The Keystone mine has produced at least $14,000,000 worth of gold. Excellent ore was followed to a depth of 1000 ft., but below that for 400 ft. little of value, it is said, was mined. About three years ago some work was done on the property, but it soon passed into the hands of a receiver who sold the property for $150,000 cash to W. J. McGee and associates, who organized a new company to work the property and took for their share 250,000 of the 500,000 $1 shares. Of the remainder 50,000 shares were placed in the treasury and 200,000 sold to the local public at par. It is said that prospecting is to be specially concentrated on the 1200-ft. level where orebodies are expected to be found in the hanging wall. A more recent promotion, also carried through by Mr. McGee and his friends, was the consolidation of the Wildman-Mahoney with the Lincoln. The latter is a famous old mine upon which much money has been spent without adequate return, but the consolidation makes available for cheap prospecting a large and promising territory. In the present company the Lincoln mine is represented by 200,000 shares, of which half went to the owner of the property and the other half was sold at 50 c. per share to provide working funds. The consolidation was financed by issuing 200,000 additional shares which were sold under terms that averaged 35 c. per share, so that the new company now has funds as well as territory. The interesting features in these promotions were that the financing was local, the promoter's profits moderate, and the companies were floated, not on the basis of ore developed, but as mines of good record where there was an excellent chance of finding ore. There are a number of such properties on the Mother Lode, and that those most familiar with it are disposed to assume the risk speaks well for its future. Not only local men, however, are becoming interested. The App mine was under examination this year for the United States Smelting, Refining & Mining Co., and when no trade resulted, the Tonopah-Belmont people took a look at it. With what result, is not yet known. Hennen Jennings and some associates are working on the Mariposa estate, and Bewick, Moreing & Co., under the advice of W. J. Loring, who has long been familiar with California conditions, is reopening the Plymouth. French investors have become interested and are spending money, unfortunately without much results, on the Tarantula (it is popularly said they are 'stung'), and the Jumper. At the latter some $200,000 has been spent, but as it was devoted mainly to work on the surface little of value resulted. Control has recently passed into new hands and it is said that sinking will soon begin. If this be done there is at least a fair chance that the venture may prove profitable after all, especially since an excellent engineer is now in charge. The Mother Lode is no place for fancy promotions, but to those who are willing to spend money in an effort to make real mines, there is an excellent field.

**Alaska,** except for wireless telegraphy, would have been out of direct communication recently, since the cable from Seattle to Sitka has twice been broken by submarine disturb-

ances. The latest break, April 6, occurred when the cable ship *Burnside* was out of commission, and it is announced that repairs may not be made for some weeks. Fortunately communication is no longer dependent upon cables stretched over treacherous sea bottoms and no great inconvenience has resulted. One of the properties in the Silver Bow basin, back of Juneau, has gone into the hands of receivers. The Alaska-Ebners Gold Mines Co., owned in addition to the northward continuation of the Alaska Perseverance-Alaska Juneau lode, the Ne Plus Ultra at Madera, California, and the Bristol Cons., at Pioche, Nevada. The Ebback is the great annual sporting event. The race for 1912 closed April 8 at 1.32 a.m. and was won by A. A. Allan, driving a team of malamute dogs, owned by Mrs. Charles E. Darling, of Berkeley, California. The time was 87 hours and 32 minutes, being 5 hours and 32 minutes longer than last year, when the same team won. Alexander Holmsen, driving John Johnson's team of Siberian wolfhounds, holder of the record of 71 hours, 14 minutes, came in second, about one hour behind the winners. The other teams finished the race, which was won in the last 50 miles, when the winning team averaged 7 miles an hour. The

*PROSPECTORS IN ALASKA.*

ners mine was considered the most important of its holdings and plans were announced a year or more ago for a 200-stamp mill. Grading was completed and the greater part of the plant shipped to Juneau, when the company lost to the Alaska-Juneau important water rights that had been in litigation. Without the water, the ore is admittedly of doubtful value, as the lode though large is low-grade. There was also dissatisfaction with the promotion of the company, in which George Bent had taken an active part. The receivership is a friendly one, and in the Federal District Court at New York, which established it, the liabilities were listed at $3577 and the assets at $122,000.

**The Dog Derby.**—What the Derby is to London the All-Alaska sweepstakes is in the Far North. A 412-mile dog-train race over the snow and ice from Nome to Candle and race was one of the hardest ever run in the North, as a severe storm was raging and one team was lost in the snow for several hours. Ideals of sport vary the world around, and in the Far North men play as hard as they work.

**The California oil industry** is in a flourishing condition, according to the report of the Independent Oil Producers' Agency, made public on April 10. Contracts now on hand call for over 52,000,000 barrels, to be supplied on demand. Probably 60% of this will be taken, indicating a consumption of 31,000,000 bbl. The storage credit of the association on January 1, 1911, was 9,126,330 bbl., the receipts 15,006,388, making the volume of the oil handled during the year 24,132,709 bbl. The deliveries, most of which were of the Union Oil Co., amounted to 14,004,102 bbl. The total net sale was $4,940,887, the storage price

of oil to the agency being 35·7 c. per bbl., and the net price 31·91 c. per bbl. L. P. St. Clair was elected president of the Association for 1912, and W. B. Robb, secretary. New members of the board of directors are M. P. Flickinger, E. S. St. Clair, Frank McQuigg, A. J. Wallace, J. H. Rainey, W. O. Miles, and F. C. Berry.

Water is becoming a serious menace in the oilfields of California and its harmful effects are beginning to be in evidence everywhere. Many wells, which were productive of oil but a short time ago, are now yielding only water, while those producing 60 to 85% water are common. This unwelcome condition is the result of what may, by stretching the significance of the term, be called a disturbance of isostatic equilibrium. Before sinking wells, the oil, water, and gas existing in the strata beneath have adjusted themselves accordingly to their relative specific gravity; when wells are sunk and the oil is drawn off, this equilibrium is disturbed and eventually an irruption of water into the oil-wells follows. Other factors enter into the problem: wells may serve to conduct water from water-bearing strata into oil-bearing sand, either through leaks in or around the casing; small companies, failing to find the expected oil, have neglected to plug non-productive wells; and, by inadvertently drilling through the oil-bearing strata into beds beneath, the water may pour in. The chief problem in securing relief is to persuade operators who are not yet suffering from water to undertake expensive work for the general good. It is hoped to secure State control, as the most effective method of meeting the situation, but remedial legislation in America is always so delayed and the problem is of such pressing importance that for the present voluntary associations will have to provide funds and a competent engineering staff. Haphazard work can be of no permanent value, a neglected part of a field serving to nullify all the effort spent elsewhere. W. H. Storms, the State Mineralogist, is taking a leading part in the movement to correct the evils that have arisen, but is greatly hampered by the fact that the State has provided no funds for work of this nature.

**Defective land-laws** also confuse the situation in the oil districts. Quite aside from the fact that the railroad-grant lands of the Southern Pacific railroad company have proved oil-bearing since being patented, and that the United States authorities are questioning the title of the railroad company, fundamental problems arise from the fact that the mineral-land law was drawn without any reference to the occurrence of petroleum, so that when petroleum lands were taken up the only possibility of doing so was under the provisions of the law covering placers. It is obvious that placer-gold and petroleum are so fundamently different in methods of occurrence and recovery that confusion is inevitable. It would seem that any change in the law would be for the better, but proposed changes are the subject of much discussion, the issues being confused. Those most concerned have private interests at stake and are scarcely inclined to look at the matter in a statesmanlike way. In addition, the oil industry developed so rapidly that there was a tremendous demand for legal advice on the dubious questions involved in stretching the placer law to cover petroleum locations, with the result that the growth of legal knowledge in the oilfields was forced. As a result, companies have become involved through no fault of their own and, realizing that their grasp upon their holdings is at best precarious, naturally oppose change of any kind as likely to cause it to fail entirely. In any case, no legislation is likely to be enacted at the present session of Congress.

**Petroleum.**—March dividends from California petroleum companies reached the comfortable total of $745,842, to which it is customary to add the $80,000 dividend of the Mexican Petroleum, Ltd., since the latter is owned largely in California, though operating in Mexico. The detailed list is as below:

| | | |
|---|---|---|
| Amalgamated | $2·00 | $100,000·00 |
| Buick | ·04 | 127,254·16 |
| Caribou | ·025 | 8,070·30 |
| Central | ·015 | 15,400·00 |
| Claremont | ·015 | 7,500·00 |
| Columbia | ·01 | 9,992·26 |
| Fullerton | ·05 | 30,000·00 |
| Home | ·10 | 7,500·00 |
| Homestake | ·01 | 1,000·00 |
| Mount Diablo | ·015 | 7,500·00 |
| Monte Cristo | ·025 | 12,500·00 |
| New Pennsylvania | ·005 | 2,500·00 |
| Paraffine | ·01 | 3,000·00 |
| Record | ·01 | 10,000·00 |
| Rice Ranch | ·015 | 4,500·00 |
| San Francisco-McKittrick | ·10 | 5,000·00 |
| Sauer Dough | ·02 | 7,500·00 |
| Section Twenty-five | ·25 | 10,000·00 |
| Silver Tip | ·05 | 15,000·00 |
| State Consolidated | ·01 | 5,000·00 |
| Traders | ·006 | 9,000·00 |
| Union Oil | ·006 | 183,387·50 |
| Union Provident | ·006 | 90,787·60 |
| United Petroleum | ·006 | 48,450·60 |
| Western Union | ·01 | 10,000·00 |
| W. K. | ·03 | 15,000·00 |
| Total California Companies... | | $745,842·42 |
| Mexican Pet. Ltd. pfd. | 0·02–3 | 80,000·00 |
| Total. | | $825,842·42 |

# CONDITIONS IN MEXICO

By T. LANE CARTER.

WAS there ever a more unfortunate country than Mexico? After a long and costly revolution, a new president was elected by a vast majority of the Mexicans, and engineers looked for better times. When General Reyes returned to Mexico and completely failed to stir up any opposition to President Madero, people considered this a good omen for the new administration and predicted a successful mining year for 1912. But trouble soon commenced in earnest for Madero. Disturbances grew serious in Chihuahua, and after awhile it became apparent that a brand-new revolution had commenced in Northern Mexico, fostered to a large extent by a number of renegades and soldiers of fortune who seem to infest the border line between Mexico and the United States.

One of the first men to join Madero in his fight against Diaz was Pasqual Orozco, formerly a freighting contractor for some mines in southern Chihuahua. No fair man can pardon the treachery of Orozco. To him, more than to any man in Mexico, is due the new revolution. Had he been loyal to his chief, Zapota, another revolutionary leader, would have been defeated long ago. As yet, Orozco has not proclaimed himself president of Mexico, but no one will be surprised if he does.

*The Mining Magazine* deals with mining, not with politics, but in writing about mining conditions in Mexico at the present time, it is necessary to deal with the political state of affairs, on account of the dislocation of the mining industry caused by the lawlessness now prevailing in the country. Most engineers acquainted with Mexican conditions prophesied from the start that Madero was not the man to keep order in the country. The transition from the stern, strong rule of Diaz, to the ultra-liberalism of President Madero, has been too sudden. During his campaign, Madero made many promises which he has not been able to carry out, such as the breaking up of the large estates; and the gullible peons, who followed his standard so freely, have forgotten their former leader, who has not made them all rich, and are ready to shout 'Viva' and to hail any new 'general' who might appear.

As regards the ultimate outcome, one can only say in the favourite phrase of the country, *Quien sabe?* The friends of Mexico hope that Madero will win, but the task seems to require a man of sterner calibre than the present president of Mexico. The old saying, "Might and right rule the world; might, till right is ready," is as true in Mexico as elsewhere. Many question whether Mexico is ready to be governed by right in its present stage of the development, rather than by might. Madero is a man of high ideals, who is ahead of his time. As he is so intimately acquainted with the importance of the mining industry in Mexico, engineers sincerely hope that he may remain in power. But his present administration is proving unable to cope with the situation. With the exception of Sonora, Baja California, and one or two of the smaller states, Mexico is in a most unruly condition. Bands of loafers and robbers roam wherever they please, and it is no exaggeration to say that in many sections of Mexico today there is no recognized authority, and that lawlessness is rampant.

This unsettled state of affairs is having a disastrous effect on mining in Mexico. Hundreds of prospectors and small mining companies are stopping work, and the amount of new capital going into Mexico is growing less and less every day. The inhabitants will learn again how entirely dependent they are on outside capital for their existence. Once stop the flow of money into Mexico to develop its resources, and its industries soon languish. On account of the unsettled state of affairs, thousands of small farmers are afraid to plant their crops, so that there will, no doubt, be a big decrease in farm products.

The reader seated in a comfortable and safe mining centre situated somewhere in Greater Britain, must not picture Mexico at present as flowing with the blood of patriots. As a matter of fact there is much of the opera bouffe about this ridiculous revolution. One day we read that after a terrific battle, the insurrectos captured the city of Parral. Looking down to examine the list of killed and wounded, with the expectation of finding that half the population of Mexico had been annihilated, we find that three men and a mule represent the slain in the sanguinary battle of Parral.

Next day we read that the federals have gathered themselves together, and after a gallant assault, have stormed the heights and re-

gained the city of Parral, with a total casualty of one man scared to death. No, there are not many big battles, but just enough blowing up of bridges and railroads, killing of federals or insurrectos, and hampering of industry, to discourage every one connected with mining. If you have a high-grade engine working satisfactorily, it does not require a keg of powder to knock it out of commission. Just get the gears out of order, or throw a bolt where it can do the most damage, and you will stop the machine. So it is with the mining industry of Mexico. These constant pin-pricks are doing untold harm to the foremost industry of the country.

Of course, the companies like the Greene-Cananea copper company, El Oro, etc., are not having much trouble, for they are strong enough to defend themselves, and in most cases neither the federals or the revolutionists bother the big operators. It is the scores of small mining men and companies throughout Mexico that are suffering most. In many places it is practically impossible to get any kind of protection, so that all work has been abandoned until law and order is restored. The suffering and loss amongst the 'little men' has been great. Hundreds, acting on the advice of the proclamation of President Taft, have left the country with their families, and are out of work. Foreigners in Mexico are bitter against President Taft on account of his proclamation. It was an admission that the government of the United States felt unable to protect its citizens in Mexico. The effect on the natives has been to lead them to believe that the United States is too weak or lazy to look after its citizens abroad. I have frequently heard the exclamation, "Oh for a Cleveland or a Roosevelt in this crisis."

Will the United States intervene in Mexico? Not if it can be possibly avoided. McKinley loved peace, but Taft is even more peaceably inclined. Probably the principal reason why President Taft is so loth to interfere in Mexico is that he realizes that if the United States ever commences the job, it will be one of the biggest and most expensive his country has ever undertaken. It is highly probable that if the United States troops crossed the Rio Grande all the factions would join against the invaders. Any one acquainted with Mexico knows that it is a very trying country for military operations. If there is any possible way out of the dilemma, the United States government will not interfere.

Recently, with the consent of the Mexican government, there was imported into Mexico arms and ammunition to be distributed among the foreigners. These arms are to be used by Americans and others for their defence. This importation has relieved the fear of the foreigners in Mexico, and the fact that they are now well armed is known to all factions in Mexico.

Considering the unsettled condition of affairs in Mexico, the number of foreigners so far killed has been small. It is my belief that the importation of arms for their use will do much to allay the feeling of panic which was felt by so many when Taft's proclamation was known. While there has been a cessation of work in a number of districts, many engineers have gone through the country on their duties of examining mines. Some of the engineers have had exciting adventures, and in one or two cases known to the writer, presence of mind has saved the lives of the travellers when they were held up by bandits. One engineer was trailing over a lonely mountain. It occurred to him to stuff his paper money, several hundred dollars, into his boots and keep only a few silver coins in his pocket. Ten minutes later he ran into a band of desperadoes who held him up. Being fluent in Spanish the engineer spoke most graciously to the bandits, and said he sympathized with them in the poor prize they had drawn, but that he would give up cheerfully what was in his pockets and his bag. He then emptied his pockets of all the silver, and handed around his fine cigars. He suggested that the leader search him, but so completely had he captivated them by his manner, that after an hour's conversation, he left the band with many fervent *Adios* on their part, and the loss on his side of only a few dollars and some cigars. Had he taken a different attitude, he would have been killed. This engineer was not only an excellent judge of mines, but was also expert in the art of handling bandits.

Amidst all this pessimism in Mexico, there are men who, taking a more hopeful view of the situation, are getting mines and prospects under option, at prices far below their intrinsic value. They declare that the present difficulties will be adjusted, and that when permanent peace comes, and the mines are in full swing again, the industry will have the biggest move forward that has ever been known. All that Mexico needs now, to make mining boom, is peace, for with copper selling for 15½ to 16 cents per pound, and silver for 58 cents to 60 cents per ounce, the mines will make big money.

Any one acquainted with the remarkable

MEXICO
Scale of Miles
0 50 100 150 200 250
UNITED STATES
CALIFORNIA
ARIZONA
NEW MEXICO
TEXAS
ARKANSAS
LOUISIANA
MISSISSIPPI
ALABAMA
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
DURANGO
SINALOA
ZACATECAS
SAN LUIS POTOSI
TEPIC
JALISCO
GUANAJUATO
HIDALGO
MEXICO
MICHOACAN
GUERRERO
OAXACA
CHIAPAS
TABASCO
YUCATAN
CAMPECHE
QUINTANA ROO
VERACRUZ
PUEBLA
MORELOS
OAXACA
GUATEMALA
HONDURAS
BRITISH HONDURAS
Yuma
Cliffon
Tucson
Bisbee
El Paso
Nogales
Cananea
Nacozari
Hermosillo
Guaymas
Yaqui R.
Bolea
Chihuahua
Parral
Laredo
Rio Grande
Austin
Galveston
Pensacola
New Orleans
Monterey
Saltillo
Torreon
Culiacan
Durango
Mazatlan
La Paz
Tampico
San Luis Potosi
Aguas Calientes
Guadalajara
Guanajuato
Queretaro
Pachuca
Tuxpan
Jalapa
Vera Cruz
Morelia
Colima
Manzanillo
Puebla
Minatitlan
Acapulco
Oaxaca
Tehuantepec
Campeche
Belize
Gila R.
Gulf of California
Lower California
Pacific Ocean
GULF OF MEXICO

mineral resources of Mexico must realize that anarchy cannot prevail permanently in a country such as this, where millions have already been invested, and where millions more will go. The well-wishers of Mexico hope that Madero will be strong enough to put down all opposition.

One of the most unfortunate phases of the disturbances so far is the fact that the better class of Mexicans have been so apathetic, and have not done their duty in the cause of law and order. The 'bad men' of Mexico have been too much in evidence, and no country in the world has a more liberal supply of 'bad men' than Mexico. The country is being terrorized in many parts by these 'bad men' who are bandits, not revolutionists. Let them put in Orozco as president, and they would start a revolution or row the next week, just to have something to do. Say what you like about Diaz, but there is one thing he knew how to do, and that was to deal with 'bad men' and traitors. His remedy of 'shot at sunrise' was severe, but it was effective.

Lately Madero has appealed to the patriotism of his fellow citizens, and in many centres demonstrations have been held and resolutions passed upholding the government. If Madero can only arouse the enthusiasm of the better class of Mexicans, and induce them to volunteer in large numbers, he will yet be able to save his country from anarchy, and the intervention which would be almost as distasteful to the United States as to Mexico.

I saw much of the political campaign when Madero was elected president of Mexico by an overwhelming vote of the people. That a man who was fairly elected president should be driven from his office before he has had a chance is an outrage, and the whole world sympathizes with Madero.

From what has been written, the reader must not think that mining in Mexico is coming to a standstill. The big mines are too wonderful to be entirely closed by revolutionists. I have already used the expression 'pinpricks' in connection with the effect of the disturbances on the mining industry in Mexico. In northern Mexico, on account of the interference with the railroad, the smelters are having difficulty in getting supplies, and will be forced to close, unless peace is restored. Such districts as Pachuca have scarcely felt the effects of the disturbances and the output of silver is as large as ever.

Six months ago, the Hostotipaquillo district, in Jalisco, about 100 miles west of Guadalajara, was attracting a great deal of attention. Temporarily, the disturbed condition of the country has stopped much of the exploratory work there. Talk now to a financier about a proposition in this part of Mexico and he will say: "See me after the revolution." The same condition of affairs exists in the state of Oaxaca, where a great many development undertakings were going ahead when this revolution broke out.

Men who have mined in Mexico are always glad to get back there again. There is a fascination about the country in spite of revolutions and dirt. To scores of engineers, the present restricted operations in mining mean that they are out of employment. To them it is of vital importance to see peace restored in the republic. With all the friends of the country, they will exclaim *Viva Mexico.*

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**Copper.**—Messrs. Aron Hirsch & Sohn, of Halberstadt, give the following figures:

WORLD'S PRODUCTION IN LONG TONS.

| | 1910 | 1911 |
|---|---|---|
| United States | 482,200 | 487,300 |
| Japan | 50,000 | 55,000 |
| Mexico | 58,800 | 54,050 |
| Spain and Portugal | 53,000 | 55,000 |
| Australia | 43,400 | 44,600 |
| Germany | 28,800 | 30,500 |
| Chili | 35,800 | 29,600 |
| Peru | 26,000 | 26,000 |
| Russia | 22,300 | 25,500 |
| Canada | 22,500 | 24,000 |
| Sweden and Norway | 7,000 | 9,500 |
| Cape Colony | 7,000 | 7,000 |
| Italy | 3,000 | 3,000 |
| Austria-Hungary | 2,250 | 2,520 |
| Bolivia | 2,500 | 2,500 |
| Newfoundland | 2,100 | 2,100 |
| Other Countries | 10,500 | 11,200 |
| Total | 857,150 | 869,370 |

WORLD'S CONSUMPTION IN LONG TONS.

| | | |
|---|---|---|
| North America | 334,565 | 316,791 |
| Germany | 208,826 | 234,985 |
| England | 148,187 | 159,736 |
| France | 92,838 | 106,408 |
| Austria-Hungary | 37,150 | 41,101 |
| Italy | 32,487 | 40,949 |
| Russia | 28,237 | 31,830 |
| Asia | 20,000 | 24,500 |
| Belgium and Holland | 14,000 | 13,000 |
| Scandinavia | 9,500 | 9,500 |
| Other Countries in Europe | 2,500 | 2,500 |
| Central and South America | 3,000 | 3,000 |
| Africa and Australia | 2,000 | 2,000 |
| Total | 933,290 | 986,300 |

# THE CORNISH TIN TICKETING

By HAROLD E. FERN.

A LEADING article in this Magazine for January last, which briefly dealt with the method adopted by the chief producers of Cornwall for the sale of their tin concentrate, drew attention to a system which bears heavily on the tin-mining industry of Cornwall, and as I have had occasion during the past few months to study the question closely, the result of my investigations may not be without interest to those who are concerned with Cornish mining affairs.

When the ticketing for tin ores was instituted some 25 years ago, largely through the instrumentality of Mr. A. Strauss, owner of the Penpoll smelter, it was hailed as being a great advance on the crude methods of sale and purchase previously existing, inasmuch as it introduced competition between the smelters. It is one of the purposes of this article to show that this expected competition does not sufficiently exist today.

The ticketings are held fortnightly at Redruth on Mondays, and on the previous Friday, a mine having tin concentrate to sell either sends samples by post to the smelters, or the representatives of the smelters call at the mine to take a sample. The concentrate is wet, and excluding slime averages from 6 and 8% of moisture, and on the samples taken the smelters are supposed to base their bids. It was suggested in the article of January last previously referred to, that as the concentrate is not re-sampled on delivery at the smelting works, it was possible to liberally water the parcel after the samples had been taken, and so the smelter might conceivably be "paying for water at the price of tin." I had some difficulty in suppressing a smile at this suggestion. In delivering the concentrate, the evaporation is sometimes considerable, particularly if the weather is hot, while as the trucks conveying the concentrate are tarpaulined, any rain that falls on the way to the smelting works has little, if any, effect.

Having taken samples, the smelters bid on each parcel submitted for sale, commencing with those offered by the premier mine, Dolcoath, down in order of quantity to the smallest lot put in. Bids are not made usually for lots under one ton. It is claimed for the ticketing by its adherents that there is genuine competition by the smelters for the parcels offered. I believe this is true for the first and larger parcels offered, but the experience of a Cornish mining company with which I am officially connected (Wheal Kitty & Penhalls United, Limited) leads me to doubt whether the smaller mines get the benefit of genuine competition. As proof of this, I present a chart showing the highest and lowest bids submitted by the smelters at the ticketing for the concentrate offered for sale by Wheal Kitty & Penhalls United, Limited, over the twelve months ended March 18, 1912. It will be noticed that the difference between these bids varies from £2. 2s. 6d. to £14., and I submit that if the bids had been based on the assays taken, there could have been no such wide differences, for as will be seen from Chart No. 2, the concentrate was of a very even grade. The fact is, the bids are partly dependent on whether the smelters are short or not of the class of tin offered; if they have been successful in filling their requirements from the larger parcels offered, then the bids for the smaller lots which follow are naturally affected to the disadvantage of the seller. As tending to confirm this view, I have noticed repeatedly during the past twelve months that the price secured at the ticketing by East Pool & Agar United Mines for their concentrate, which is from a complex ore and is notoriously lower in grade than the Wheal Kitty concentrate, has been practically the same and sometimes even higher. It may be said that it is only right that supply and demand should govern the price; that argument would be legitimate if the basis of the deal were the actual content of the ore valued at the market price on the day of sale, but seeing that at the ticketing the tin standard is the controlling factor, then the bids for *all* the concentrate offered should only vary according to the differences in the assay-value and quality.

My second chart, also covering a year's ticketings, shows that the sellers do not get the full benefit of a rise in the price of tin. It is true on the other hand that the fall in black tin at the ticketing is not always so heavy as is the fall in the price of the metal, but my experience has been that this is only the case with temporary falls in price. If the depression is one of long duration, the smelters soon drop their bids to an even greater extent than

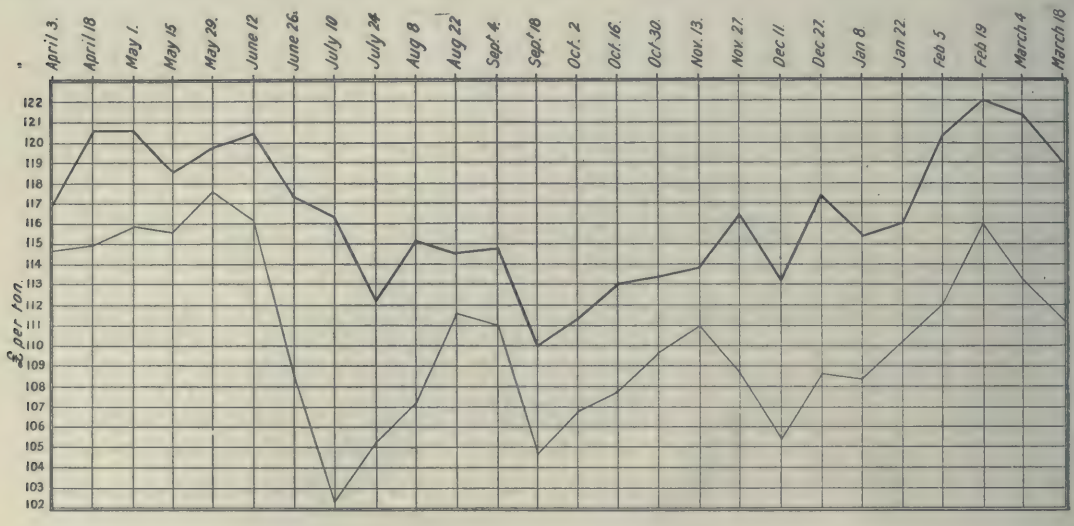
## Chart No. 1.

Highest and Lowest Bids for Parcels of Tin Concentrate offered by Wheal Kitty and Penhalls United Ltd. at the Cornish Tin Ticketings, 1911—12.

| Date of Ticketing ... ... ... | April 3 | April 18 | May 1 | May 15 | May 29 | June 12 | June 26 | July 10 | July 24 |
|---|---|---|---|---|---|---|---|---|---|
| Highest bid ... ... ... | £117'00 | £120'62 | £120'62 | £118'75 | £119'87 | £120'37 | £117'25 | £116'37 | £112'12 |
| Lowest bid ... ... ... | £114'87 | £115'00 | £115'87 | £115'62 | £117'50 | £116'12 | £108'50 | £102'37 | £105'37 |

| Date of Ticketing ... ... ... | Aug. 8 | Aug. 22 | Sept. 4 | Sept. 18 | Oct. 2 | Oct. 16 | Oct. 30 | Nov. 13 | Nov. 27 |
|---|---|---|---|---|---|---|---|---|---|
| Highest bid ... ... ... | £115'25 | £114'62 | £114'87 | £110'00 | £111'25 | £113'00 | £113'37 | £113'87 | £116'37 |
| Lowest bid ... ... ... | £107'25 | £111'50 | £111'00 | £104'87 | £106'87 | £107'75 | £109'75 | £111'00 | £108'87 |

| Date of Ticketing ... ... ... | Dec. 11 | Dec. 27 | Jan. 8 | Jan. 22 | Feb. 5 | Feb. 19 | Mar. 4 | Mar. 18 |
|---|---|---|---|---|---|---|---|---|
| Highest bid ... ... ... | £113'25 | £117'25 | £115'37 | £116'00 | £120'25 | £122'00 | £121'37 | £119'00 |
| Lowest bid ... ... ... | £105'50 | £108'62 | £108'50 | £110'25 | £112'00 | £116'00 | £113'12 | £111'37 |




is warranted by the price of the metal. On this second chart is shown: (*1*) the mean price of cash and three months tin (metal) at midday on the day of ticketing; (*2*) the average price secured for black tin (excluding slime) by all the mines at the ticketing; and (*3*) the price secured by Wheal Kitty & Penhalls United, Limited, for a concentrate of very even grade, as is shown by the continuous assays made by Mr. Arthur C. Claudet.

Then we come to the anomaly of draftage, that is the 3 lb. which the smelter is allowed to deduct for every hundredweight of black tin delivered. The consequence is that the mine has to deliver 2300 lb. for every ton sold.

Here it would be well to examine the basis for the sale of tin at the ticketing. This is the 'tin standard,' which is: "The amount paid by the smelter per cwt. of metal contained in the ore as calculated from the results of a dry assay, after deduction of 1¼ from the product per 20 (6¼ per cent.) for returning charges. By an old trade custom there is also a deduction on the weight of the parcel of tin ore of 3 lb. per cwt. It is customary to reckon the price by the nearest eighth of a £ above or below the calculated price."

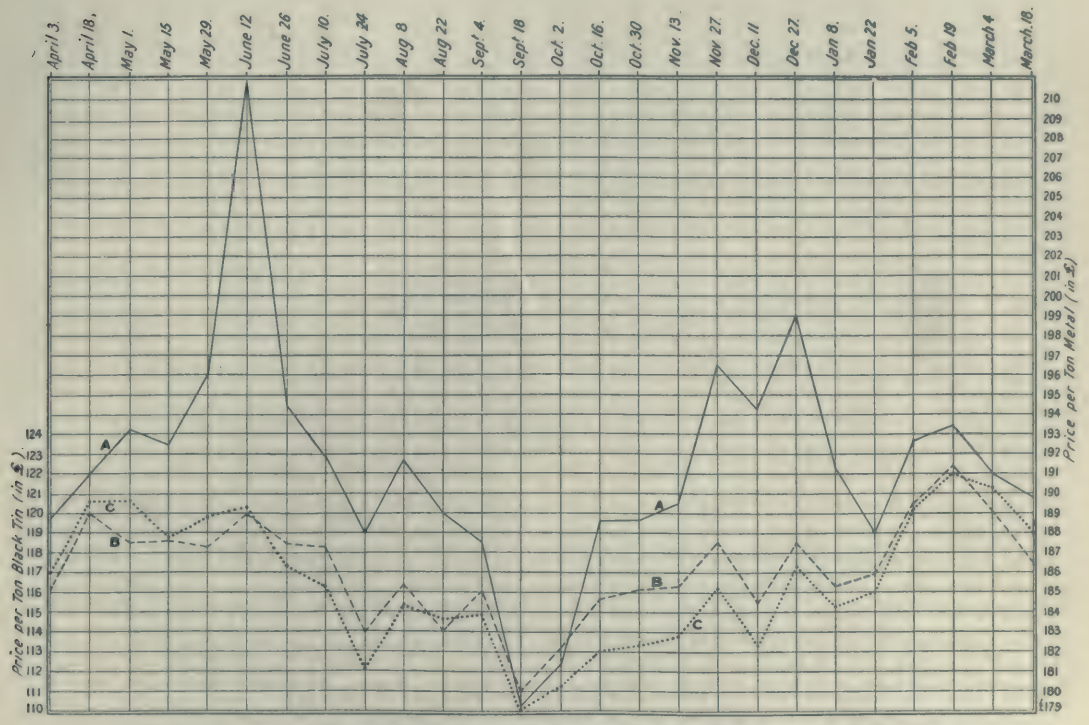
According to the ancient Tinner's Laws, the smelters were allowed this 3 lb. per cwt. "for the turn of the scale," but as that was in the days when the seller took tin metal in exchange, it was conditionally upon the same draftage being allowed upon all the tin metal delivered against black tin. Such an arrangement was then an equitable one, but with the passing of the old custom and the purchase of black tin for cash, there is no good reason why such a deduction should continue. With tin at present prices, this draftage deduction must be nearly equal to the cost of smelting per ton, so the smelter is in a fortunate position. The accompanying table shows that on 76 tons 11

## CHART NO. 2.

| Date of Ticketing ... ... ... | April 3 | April 18 | May 1 | May 15 | May 29 | June 12 | June 26 | July 10 | July 24 |
|---|---|---|---|---|---|---|---|---|---|
| Mean of Cash and 3 months tin ... | £188'75 | £191'00 | £193'31 | £192'50 | £196'00 | £210'75 | £194'50 | £191'93 | £188'00 |
| Average price secured by all mines at Ticketing ... ... ... | £116'21 | £120'00 | £118'58 | £118'64 | £118'29 | £120'00 | £118'55 | £118'33 | £113'95 |
| Price received by Wheal Kitty and Penhalls United Ltd., at Ticketing | £117'00 | £120'62 | £120'62 | £118'75 | £119'87 | £120'37 | £117'25 | £116'37 | £112'12 |
| Tin (metal) of Wheal Kitty Concentrate in the dried sample ... % | 71'40 | 72'86 | 72'75 | 72'45 | 72'50 | 72'00 | 70'45 | 71'40 | 72'05 |

| Date of Ticketing ... ... ... | Aug. 8 | Aug. 22 | Sept. 4 | Sept. 18 | Oct. 2 | Oct. 16 | Oct. 30 | Nov. 13 | Nov. 27 |
|---|---|---|---|---|---|---|---|---|---|
| Mean of Cash and 3 months tin ... | £191'75 | £189'00 | £187'56 | £179'18 | £181'25 | £188'68 | £188'75 | £189'50 | £196'50 |
| Average price secured by all mines at Ticketing ... ... ... | £116'36 | £114'00 | £116'00 | £110'92 | £113'14 | £115'76 | £116'14 | £116'36 | £118'58 |
| Price received by Wheal Kitty and Penhalls United Ltd., at Ticketing | £115'25 | £114'62 | £114'87 | £110'00 | £111'25 | £113'00 | £113'37 | £113'87 | £116'37 |
| Tin (metal) of Wheal Kitty Concentrate in the dried sample ... % | 71'60 | 72'04 | 71'85 | 71'51 | 71'35 | 70'91 | 71'28 | 72'10 | 72'08 |

| Date of Ticketing ... ... ... | Dec. 11 | Dec. 27 | Jan. 8 | Jan. 22 | Feb. 5 | Feb. 19 | March 4 | March 18 |
|---|---|---|---|---|---|---|---|---|
| Mean of Cash and 3 months tin ... | £194'25 | £199'00 | £191'37 | £188'00 | £192 75 | £193'37 | £191'00 | £189'87 |
| Average price secured by all mines tin at Ticketing ... ... ... | £115'47 | £118'43 | £116'38 | £116'95 | £120'40 | £122'40 | £120'15 | £117'47 |
| Price received by Wheal Kitty and Penhalls United Ltd., at Ticketing | £113'25 | £117'25 | £115'37 | £116'00 | £120'25 | £122'00 | £121'37 | £119'00 |
| Tin (metal) of Wheal Kitty Concentrate in the dried sample ... % | 70'10 | 71'20 | 71'10 | 70'60 | 71'10 | 72'27 | 72'20 | 72'00 |




Line A _____ represents the mean price of Tin (Metal) for Cash and three months at noon on day of Ticketing.
B - - - - - " the average price secured by all the mines at the Ticketing
C ..... " the price secured by Wheal Kitty & Penhalls United Ltd at the Ticketing for concentrate offered of the grade indicated by the assays.

cwt. of concentrate, the draftage amounted to 2 tons 1 cwt. 0 qr. 4 lb. of black tin, which at £114 per ton (the average price received by the company in question for the six months) figures out at slightly over £3 per ton.

Dealing with the returning charge under the tin standard, it will be noted that it is payable in *kind* and not in cash as is the case everywhere else. This returning charge on a 62% concentrate is close on 10%, and of course varies in monetary value with the price of tin. With black tin at £120 per ton, the returning charge under the standard is about £12.

In a recent article in the Magazine on the 'Sale of Tin Ores,' the author, Dr. O. J. Steinhart, made the assertion that the returning calculations are unfavourably affected, but it is preferable to be on the safe side. It will readily be seen that the difference between the amount realized at the ticketing, and the actual value of the parcel by assay, must obviously be the real returning charge, which, divided by the gross weight, gives the charge per ton.

To sum up, the objections to the Cornish Tin Ticketing are that (*1*) the total returning charge based on the tin standard (and including the 3 lb. draftage) is exorbitant; (*2*) there is not sufficient competition, and (*3*) the reluctance of the smelters to give the mines the full advantage of a rise in the price of tin. There can be no question of the advantage of

RECORD OF SALES AT TIN TICKETINGS BY WHEAL KITTY & PENHALLS UNITED, LIMITED.

| Date of Ticketing | Gross weight of concentrate delivered to smelter | Weight paid for after deduction of 3 lb. draftage | Price secured at Ticketing | Total amount realized for parcel | Three months price for tin (metal) at mid day on date of Ticketing | Assay: Tin (metal) in dried ore | Assay: Moisture | Weight after deduction of actual moisture | Value at three months price | Total returning charge, *i.e.* difference between amount realized at the Ticketing and market value of same concentrate at three months' price | Returning charge per ton (gross weight) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1911 | T. c. qr. lb. | T. c. qr. lb. | £. s. d. | £ | £. s. d. | % | % | T. c. qr. lb. | £ | £ | £. s. d. |
| July 10... | 6 17 1 25 | 6 13 3 15 | 116 7 6 | 779 | 118 15 0 | 71·4 | 6·7 | 6 8 1 1 | 864 | 85 | 12 7 6 |
| ,, 24... | 6 8 2 6 | 6 5 0 12 | 112 2 6 | 701 | 186 0 0 | 72·05 | 6·6 | 6 0 0 8 | 804 | 103 | 16 0 7 |
| Aug. 8... | 4 4 0 0 | 4 1 3 0 | 115 5 0 | 471 | 189 10 0 | 71·6 | 8·6 | 3 16 3 3 | 521 | 50 | 11 19 0 |
| ,, 21... | 4 19 0 0 | 4 16 1 11 | 114 12 6 | 552 | 187 12 6 | 72·04 | 7·1 | 4 11 3 25 | 620 | 68 | 13 14 7 |
| Sept. 4... | 6 12 0 0 | 6 8 1 24 | 114 17 6 | 738 | 186 2 6 | 71·85 | 7·15 | 6 2 2 7 | 820 | 82 | 12 8 4 |
| ,, 18... | 6 3 2 4 | 6 0 0 25 | 110 0 0 | 661 | 178 2 6 | 71·51 | 6·5 | 5 15 2 1 | 736 | 75 | 12 2 8 |
| Oct. 2... | 5 19 1 1 | 5 16 0 7 | 111 5 0 | 646 | 180 0 0 | 71·35 | 6·9 | 5 11 0 3 | 713 | 67 | 11 4 9 |
| ,, 16... | 6 0 0 0 | 5 16 3 4 | 113 0 0 | 660 | 188 7 6 | 70·91 | 7·25 | 5 11 1 6 | 743 | 83 | 13 16 8 |
| ,, 30... | 5 5 0 0 | 5 2 0 21 | 113 7 6 | 579 | 188 10 0 | 71·28 | 6·6 | 4 18 0 8 | 659 | 80 | 15 4 9 |
| Nov. 13... | 5 5 0 0 | 5 2 0 21 | 113 17 6 | 582 | 186 15 0 | 72·1 | 6·7 | 4 17 3 24 | 660 | 78 | 14 17 2 |
| ,, 27... | 6 6 0 0 | 6 2 2 14 | 116 7 6 | 714 | 191 0 0 | 72·08 | 7·4 | 5 16 2 20 | 803 | 89 | 14 2 6 |
| Dec. 11... | 6 6 0 0 | 6 2 2 14 | 113 5 0 | 694 | 189 0 0 | 70·1 | 6·85 | 5 17 1 13 | 778 | 84 | 13 6 8 |
| ,, 27... | 6 6 0 0 | 6 2 2 14 | 117 5 0 | 719 | 192 0 0 | 71·2 | 7·0 | 5 17 0 20 | 801 | 82 | 13 0 2 |
| Totals & average. | 76 11 3 8 | 74 10 3 4 | 114 0 0 | £8496 | — | — | — | 71 4 2 27 | £9522 | £1026 | 13 8 0 |

*Note.*—It should be clearly understood that anyone wishing to calculate the advantage of a contract over the Ticketing must take into account the returning charge (fixed, or on a sliding scale) extra cost of freight and bags (if delivery is outside Cornwall) assays, commission, weighing charges, etc., before the real difference can be ascertained.

charge in Cornwall (that is, the returning charge of the Cornish Ticketing tin standard referred to above, plus the value of the 3 lb. draftage), was about £9 to £11 per ton. Below I give a six months' record of the sales of Wheal Kitty & Penhalls United at the ticketings, which shows that Dr. Steinhart's estimate was much too low. It will be noted that in my table the total amount actually realized for each parcel is given, and then a comparison is made showing the market value of the actual content by assay, after deducting the moisture, and based on the three months' price of tin metal ruling at mid-day on the date of the ticketing. It is, of course, usual to take the mean of cash and three months as the settlement price, and as the cash price during the six months covered by the table was always higher than the three months' price, my selling on the basis of the actual content of the ore, and no doubt Cornish mining companies generally will adopt this almost universal method in years to come. One difficulty in some cases is that the leases of Cornish mines enact that the ore shall be sold at the tin ticketing, but that should not prove insurmountable.

I have to acknowledge the assistance afforded me by Mr. Arthur C. Claudet in the preparation of this paper. Without his kind co-operation, it would have been impossible for me to have presented the charts in so complete a form. The directors of Wheal Kitty & Penhalls United Ltd. have consented to the publication of the figures relating to the companies sales during the period under review, but they are in no way responsible for the opinions I have expressed or the conclusions I have drawn.

# GOLD AND SILVER IN SUMATRA

By S. J. TRUSCOTT.

THOUGH gold and silver mining in Sumatra as carried on under European supervision may be regarded as in the early stages of a larger possible development, it is interesting to have the attention called to the fact that at irregular intervals between the years 1669 and 1737, a good deal of ore was won by the old Dutch East India Company from a mine called Salida, situated about halfway down the length of the island and about four miles inland from the west coast. As this was a government enterprise the records of the work were very complete and these are in greater part still existing and to be consulted in the Hague or at Batavia. They unfold to the interested reader, more perhaps between the lines than upon them, a tale of hardship and despair sufficient to excite the sympathy of every pioneer and miner. Padang, the principal town along the west coast, lies about fifty miles away from Salida, and at this place there was at that time, and still is, an important government station. No doubt the fact that at Salida natives were obtaining gold from the rock reached the ears of the officials at Padang and led to the ultimate acquisition of the mine by the government. In due course a complete staff of engineers, foremen, and miners was sent out from Europe, and slaves, both male and female were imported from Madagascar, this entire force, supplemented by some natives, working under the protection of a sufficient number of soldiers. From the first, however, sickness and disease fell heavily upon all; the long journey around the Cape claimed many European lives before Sumatra was reached, and landed the survivors in poor condition to undertake the pioneer work of opening a mine in a country where the natives were hostile and the climate bad. If it is easy to imagine the despair of the Europeans under these conditions, what must have been the condition of the miserable slaves. Death came to many, both black and white, but as long as there appeared to be any chance of ultimate success, the gaps so caused were made good by further drafts of Europeans and slaves. The government had entered upon this enterprise with visions of millions easily to be obtained, but though many tons of rich ore were sent to Europe there was really no financial success, so that after twice stopping the work for periods of many years and twice in hope re-commencing, the mine was finally abandoned, partly because of troubles in the administration, but doubtless chiefly because gold and silver were to be obtained more satisfactorily and cheaply in the ordinary money market. Those Europeans who, escaping the pressure of despondency and the workings of disease, landed again in their own countries, must be accounted as most lucky in their generation, for they were few in number, their comrades having gone down, as pioneers always do, to provide the experience upon which others may afterwards achieve fortune. Their work went to show that a gold and silver lode of consider-

able extent did exist, but that the content under the circumstances prevailing was not sufficient to make the enterprise a success. It must be remembered, however, that the ore was sent to Europe for treatment and to cover these expenses some tens of ounces of gold to the ton would be necessary, a condition of affairs which does not of course apply to the present. That ore of such content could be obtained at all might perhaps be taken to indicate an important orebody, but too much must not be made of such figures because it was evident from the records that these were only obtained by much selection both underground and at the picking-tables.

From these early beginnings to recent times no work was done in Sumatra, but toward the end of the century just passed, work was started again more than once at Salida but not maintained, so that if the further exploration of the gold and silver occurrences of this country had had to await the lead of this mine, the advance now to be chronicled would have been greatly delayed. It was about the year 1895 that interest was aroused among the Europeans of Java by stories of the occurrence of gold in various places, and in 1896 an exploration company was formed to open up the lode upon which the Redjang Lebong mine is now working. This lode had ages ago been worked by natives, who had taken out its softer portions, leaving holes and cavities in the harder quartz to mark their work. Close to these evidences of former activity, with which however the inhabitants of the district know no connecting legend, there were many old graves marked by monoliths of a weather-resisting acid lava, and many old stone implements used for breaking and grinding the ore. No European had ever penetrated to this particular point to note these traces of a forgotten mining population, till information of their existence was taken down to the manager of a coffee plantation about fifty miles away, and from there passed on to some merchants in Batavia, who luckily enough became interested and sent a miner who happened at that time to be within call. The coffee planter and the miner made their visit together bringing back some samples, which upon assay in Batavia gave results averaging more than two ounces of gold to the ton, thus demonstrating the existence of profitable ore. The evidence of an adequate quantity was in the large extent of the old workings and in the large amount of quartz left standing. An exploration company with a capital of about £10,000 was then formed of which one half was working capital, and the proper development of the lode was started without delay. It is of interest to mention at this point that during the time of the British occupation of Sumatra, when the town of Benkoelen was the residence of the British Governor-General, a small expeditionary force had pushed its way inland into the neighbourhood where now this mine has been developed. This town of Benkoelen, situated on the west coast and in the southern half of the island, is the port through which communication with the mine is maintained, this being along a road about one hundred miles in length.

As a natural consequence of the activity at Redjang Lebong it was not long before the presence of other old workings was reported, and in due course two other exploration companies were formed to explore workings at places known as Lebong Soelit and Lebong Simau, these being also in the Residency of Benkoelen, and not far from Redjang Lebong.

Since then things have progressed until now the present position of these three mines is that Redjang Lebong has paid dividends amounting to about £1,000,000 and is making profits at the rate of about £100,000 per year; that Lebong Soelit, now called Ketahoen, has distributed dividends to an amount close upon £100,000 and is making profits at the rate of £15,000 per year; and that Lebong Simau is crushing about 250 tons per day having a content of about 10 dwt. of gold per ton. In this same neighbourhood also the Dutch Government is developing two mines with the intention of working them itself if they promise to be sufficiently profitable, but as no data are published it is not possible to give any idea of the results.

In addition to these mines situated in the Residency of Benkoelen, work has also been done at other places upon this large island. In the Lampong district, right at the south end near Telok Betong, a silver-bearing lode has been explored by a good deal of work, which has now been stopped though it is reported that encouraging results were obtained. It is however in the hinterland from Padang, in districts known as the Padangsche Bovenlanden and Benedenlanden, that interest has more recently been centred. Early in the year 1908 a lode carrying gold and silver was discovered at a place named Mangani, about fifty miles to the northwest of the town of Fort-de-Kock and just on the equator. Upon this lode no work had been done by any natives previously, so that this discovery must be put down to the credit of the Europeans concerned. Since that date a considerable amount of underground work has been done and it is reported that

about 100,000 tons of ore having an assay-value of 8 dwt. of gold and 12 oz. silver have been opened up, in consequence of which a reduction plant capable of treating 200 tons per day is now being erected. In this same neighbourhood also, at a place named Kinandam, another lode, discovered last year by natives, appears to be of promise sufficient to justify its regular development, this work being now carried out by a proper staff.

Of no less interest is the fact that work in the old Salida mine has again been recommenced under a staff, from which it may be hoped that the undertaking will this time be placed upon the road to success; in any case more definite information concerning its possibilities under present conditions will doubtless soon be available.

Still farther to the north, in the Residency of Tapanoelie, which adjoins the Padangsche Bovenlanden, a good deal of exploration work has been done in recent years, and this work is still proceeding. Near to the common boundary of these two districts there is at a place called Moeara Sipongi, in Tapanoelie, a regular gold-mining population from whence skilled labour is recruited to be employed all around. Many of the people of this place had been accustomed, as their fathers before them, to mine, to grind down, and to wash gold ores as a means of livelihood. It does not appear, however, that any of them became rich thereby, and since the advent of Europeans most of them have preferred to take the steady wage of a paid worker, though not renouncing their rights to the further use of the little workings from which they obtained their gold. In this neighbourhood an exploration company, formed last year, is working to determine the value of the deposits, the existence of which is marked by the occurrence of these native workings.

**Geology.**—The general sequence of rocks occurring in Sumatra may be taken as they were given by the government mining engineer, R. O. M. Verbeek, when dealing with a portion of the west coast in an important work published in 1883.

Sedimentary Rocks.

| | |
|---|---|
| Recent..... | River Alluvial<br>Marine Alluvial<br>Coral Limestone |
| Quaternary.... | River Diluvial<br>Limestone Tuff<br>Lacustrine Diluvial<br>Marine Diluvial |
| Eocene..... | Orbitoitic Limestone<br>Marl Sandstone<br>Sandstone with Coal<br>Conglomerate, Breccia, Sandstone and Marl |
| Carboniferous | Carboniferous Limestone<br>Culm |
| Silurian or Devonian ..... | Slates and Quartzites |

Eruptive Rocks.

| | |
|---|---|
| Recent or Quaternary.... | Andesite, Basalt, etc.<br>Tuffs, etc. |
| Tertiary..... | Older Basalts<br>Hornblende Andesite<br>Augite Andesite |
| Younger than Carboniferous | Diabase<br>Gabbro |
| Older than Carboniferous | Diorite<br>Granite<br>Quartz Porphyry<br>Syenite, etc. |

Regarding geological structure; this island is roughly 1000 miles long, with the equator crossing it at the middle, and it has a maximum width of about 250 miles. There runs practically from end to end, and in sight of the west coast, a well pronounced range of hills along which many volcanic cones occur, some reaching to a height of about 3000 m. above sea level, and several of them being at the present moment quietly active. Of this range the well known volcanic island of Krakatoa is the southern end and the connecting link with its continuation through the neighbouring island of Java. These hills all consist of recent volcanic material and chiefly of tuff which has so widespread an occurrence that in general it may be said to be the most striking rock upon this west coast. On going farther inland the older rocks are seen uncovered and in turn the diabase group, the Carboniferous limestone, the granite, and the old slates and quartzites are met. Among these, very considerable beds of Eocene age occur, in some of which seams of coal are found, these being extensively worked by the government at a place called Ombilien, It is held that the slates and quartzites represent the oldest rocks into which the granite was intruded, the whole complex forming a base for the later sedimentaries, among which the Carboniferous measures, represented characteristically by a large extent of limestone, come first. After the settlement of these beds it is considered that the diabase group was intruded, by which the land was apparently brought so high that none of the Mesozoic rocks had opportunity to be deposited upon it;

consequently where Tertiary beds occur, they are found directly upon the sedimentaries of Palaeozoic age or upon eruptives. These Tertiary beds have a considerable development in Sumatra, this being especially the case with those of the Eocene period wherein as stated above exploitable coal seams have been found. The upper beds, those of Miocene and Pliocene age, have not the same extended occurrence as their older associate, but, as against this, there is a large occurrence in Sumatra of andesite considered by Verbeek to have been intruded in the early Miocene time, a position which is confirmed by the apparent facts, that at the Mangani mine on the one hand the intrusion of the andesite into the Tertiary beds is seen, and that at the Soelit mine on the other hand, the flanks of a similar intrusion are covered by flat beds of marl and coral limestone considered to be of Miocene age.

This andesite rock has been defined to occur in great extension in the southern half of the island, where it runs in a line parallel to the coast from the south end of the island up to and beyond Padang, passing there into the sea to reappear, though in less prominence, farther to the north. Along the higher part of this described extent it forms a range of hills known as the Barisan which, it is considered, represents the principal line of fracture along which the andesite was intruded and with which any other more isolated occurrences of this rock are doubtless connected. After this tremendous intrusion came the deposition of the other Tertiary beds, the extent of which however has been considerably obscured and overshadowed by the later depositions of volcanic origin, which continuing up to very recent times are in greater part responsible for the present topography of the country.

**Ore Occurrence.** — Most of the occurrences of gold and silver ore which have so far been developed occur in connection with andesite and in the neighbourhood of Tertiary sedimentary rocks, from which fact and from the appearance of the rock itself it may be considered that the andesite also is of Tertiary age, forming part of the extensive intrusion which has been put down as having occurred in the early stages of Miocene time. It is often the case that with the andesite there are more limited occurrences of rhyolite possibly in the nature of later intrusions, such occurrences being particularly noticed in the immediate neighbourhood of the orebodies.

At Redjang Lebong the foot-wall of the lodé is rhyolite, but it is difficult to say what was the rock which formed the hanging wall at the time of the formation of the lode. There exists in that position now a boulder clay, the boulders being of hard dark-coloured compact andesite and the clay being grey in colour and often pyritiferous. Some say that this whole occurrence is one of andesite decomposing *in situ*, but there is also the view that it is clastic volcanic material arranged by water. In such a case the original hanging wall of the lode has been removed, to which removal, were the rock andesite propylitized, no great resistance would be offered by reason of the ease with which such a rock weathers. There is in favour of this view the fact that in more than one place in the hanging wall there is a small thickness of altered eruptive rock which it was usual at the mine to refer to as the 'propylite.' At Lebong Soelit the north wall is rhyolite and the south wall andesite, the lode standing vertically; between this place and that first mentioned there are occurrences of Tertiary sedimentary beds consisting chiefly of sandstones and marls, and in the neighbourhood of the lode itself the andesite is seen to be overlain by beds of marl and coral limestone stated to be of Miocene age. At Lebong Simau it is stated also that the lode is at the contact of rhyolite and andesite; between this place and the last mentioned there are occurrences of Tertiary rocks which include some limestone. At Tambang Sawa and Lebong Simpang, two occurrences of gold and silver ore which are being opened up by the government, the country rock consists in greater part of andesite. In the neighbourhood of the former place an outcrop of granite is exposed. The silver lode already referred to as occurring in the Lampong district, in contradistinction to the above mentioned association of the lode with andesite, occurs in the slates and schists of the oldest formation. Apart from this however the character of the lode itself and the nature of its contents agree very well with those occurring in the more usual country rock.

In the Padangsche Bovenlanden and Benedenlanden the association of andesite with the lodes is again marked. Both walls of the Mangani lode are of andesite which has here been much altered by surface and underground waters. In the neighbourhood the conglomerate beds representing the lowest stage of the Eocene are prominent, and it is evident that the andesite broke through these beds. At Kinandam the occurrence is also that of a quartz lode in an andesite mass, and in the neighbourhood there are beds of Tertiary age. And lastly at the old mine of Salida the lode occurs in

andesite and on the same concession there are Tertiary beds containing coal. In this part of Sumatra the association of the lodes with andesite is now held to be so constant that the first step toward making further discoveries of gold and silver ore is to find other occurrences of that rock.

Going farther north, however, into the Residency of Tapanoelie, there appears to be another association. In the southeastern corner of that Residency the rocks of the early granite group show themselves entirely uncovered in the valleys and on the foot-hills, whereas on the higher ground they are covered by Carboniferous limestone. At the junction of these two rocks, where the limestone was deposited on the granite, the former is now found in many places completely altered, and marble, wollastonite, garnet, quartz, and epidote occur, together with ores of copper, gold, and silver. It is considered moreover that the occurrence of these minerals and ores has relation to the presence in the immediate neighbourhood of wide dikes of diabase in which there are persistent fractures and crush-zones with small auriferous quartz veins containing a good deal of ordinary pyrite and of arsenical pyrite. It is easily conceivable that the intrusion of these dikes gave occasion for mineral solutions to drench the junction of the granite and limestone as along a plane of small resistance, and that the deposition of ore together with the alteration of the limestone resulted.

It must be mentioned however that in the same neighbourhood the usual association of andesite and auriferous quartz is also seen, though in spite of this and of the inclination to bring everything into line with the general occurrence it would appear likely that the occurrences in connection with the diabase are separate and of an earlier age.

**Lode Characteristics.**—The lode at the Redjang Lebong mine, as stated before, occurs with a rhyolite in the foot-wall and probably with andesite in the hanging wall. Its general strike is N 35° W, though curving somewhat to the west at each end, and it dips about 75° in a direction N 65° E. Its length is roughly 900 feet and its average width 40 feet, these being the measurements of the orebody. The principal fracture continues at either end beyond the above mentioned length, but within the limits of the exploration work no further ore has been found. At each end the ore pinches out quickly, and though by the appearance of the stope faces it is known that the end is approaching the actual stopping of the stope is determined by the assay-value of the material

*THE REDJANG LEBONG MINE.*

broken. At either end also, it is interesting to note, the rhyolite in the foot-wall curves its outline to the west quicker than the lode and in the intervening space the thin edge of a slate wedge occurs in as shown in Fig. 1. At the same time the valuable contents decrease and with them the width of the ore, because though there are quartz veins and stringers in the slate, this rock is nowhere impregnated so as to contain anything of value within its own mass. Within the comparatively short length of this lode there are two distinct occurrences of better ore, one towards either end, leaving the centre of decidedly lower grade. This distribution of values has so far been confirmed in every lower level, the orebody apparently pitching a little to the south. This latter fact is worthy of note because on both walls of the lode there are grooves cut in a direction to indicate that the last movement took place in the same direction. In cross section the lode is characterized by the deposition of silica in parallel bands toward the hanging wall, and in concentric layers around pieces of the country rock toward the foot-wall; in which direction also, though there is generally a distinct wall marked by the above-mentioned grooves, the lode and country rock sometimes pass into one another through veins of quartz lying parallel to the wall. In the other direction the limit toward the hanging wall is marked, first by a pronounced grooved wall, and then by a breccia of small white quartz fragments in a silicious cement, beyond which again there usually exists a small thickness of crushed material or of propylite before the clay is reached. In stoping the lode, all the material to the boulder clay on this side is taken, and toward the foot-wall all the material up to the country rock, providing the assays show that it is worth taking, the entire width being on an average about 40 feet. The richest portion is always the parallel banded quartz, in the centre of which there is generally a darker vein of very high content. A typical section is represented in Fig. 2, from which the structure is well seen. The fragments in the foot-wall have generally kernels of altered eruptive rock and envelopes of quartz by the accretion of which they have become often so large and rounded as to be best described as boulders; sometimes in the place of eruptive rock the kernels are of slate. The nature of the breccia in the hanging wall would indicate that the quartz pieces in it are pieces broken from massive quartz by a movement subsequent to its deposition. The principal lode-filling is silica, in greater part quartz and in lesser part chalcedony after silica comes calcite which is generally found as compact calc-spar in the central portion of the section. This mineral occurs however chiefly in the neighbourhood of the slate where some of the rock, poorer than would allow of its being mined solely for the gold it contained, was mined because of the neutralizing effect which its contained calc-spar exerted in the reduction works upon the acidity of the more oxidized ore. The foot-wall portion of the lode and the adjoining country rock are often traversed by small veins of calc-spar or of a white calcium silicate, which latter in the interstices between the boulders has sometimes found occasion to crystallize out in nice crystals of the mineral apophyllite. Occasionally also there are veins of silicate and carbonate of manganese in the foot-wall country.

Reference to the diagrammatic plan of the orebody in Fig. 1 shows how that the rhyolite departs from the lode at both ends, the gradually enlarging space between the two being occupied by slate. To the south the contact between slate and rhyolite is marked by a well pronounced quartz lode which extends in a direction due south. With this lode there is a good deal of calcite, so that though it only assayed about 3 dwt. gold per ton, the ore broken in driving upon it was sent to the battery for the reason mentioned above. At the north end the contact with the rhyolite offered no encouragement to being followed.

The ore contains very little pyrite or ordinary sulphides, the average amount of these being less than 1%, and of this the precious metal content is not high. Apart from the free gold and silver, which allow respectively about 15% and 3% of their amounts to be obtained by ordinary plate amalgamation, the general association of the noble metals appears to be with selenium. So much is this the case that the cyanide bullion generally contains from 1 to 3% of this element, this amount remaining after a considerable quantity has palpably been driven off in the processes of roasting and smelting. The presence of selenium in the ore does not appear to adversely affect the extraction by cyanide, this depending rather upon the fineness to which the ore is reduced, current practice in this respect recording extractions of 90% of the gold and 80% of the silver by ordinary cyanidation. It is here pertinent to remark that no tellurium has yet been found, a fact which is reflected in these satisfactory extractions.

Comparing the assay-values obtained on succeeding levels it may be said that the highest figures were obtained on the second level at a

depth of about 125 feet below the surface. Above this the contents were lower, and this is also the case at present in the deeper levels, though these still remain good. It is noticeable that in depth the proportion of silver to gold has fallen considerably, this proportion at the present bottom being by weight about 1 : 4 as against 1 : 10 at the surface. Another noticeable occurrence was that in a stope just above the second level native gold and silver occurred in a cavity between boulders near the footwall, this fact being worthy of record because

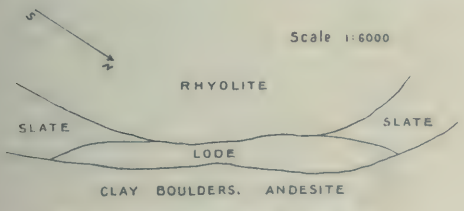



FIG. 1 - *Diagrammatic Plan of the Lode at Redjang Lebong.*

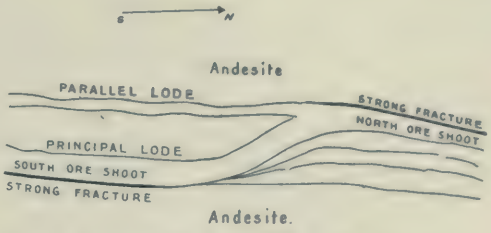
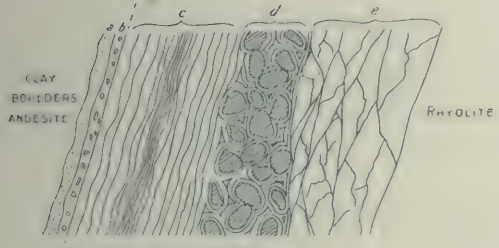
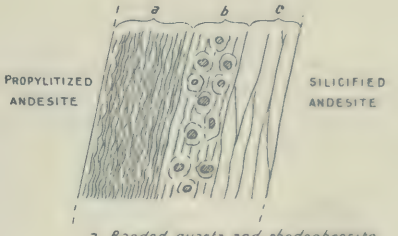



FIG. 3. - *Diagrammatic Plan of the Lode at Mangani.* Scale 1:6000.




a. *loose quartz rubble*
b. *Quartz breccia.*
c. *Massive and Banded Quartz*
d. *Concentric ore.*
e. *Rhyolite traversed & impregnated by Quartz &c*

FIG 2 *Diagrammatic Section of the Lode at Redjang Lebong* Scale 1:300




a. *Banded quartz and rhodochrosite*
b. *Concentric ore*
c. *Andesite with quartz veins.*

FIG. 4:- *Diagrammatic Section of the Lode at Mangani* Scale 1:300

visible gold in the ore of this mine is rare. The association of the noble metals with selenium will probably be rightly regarded as part of the primary ore deposition, and similarly the enrichment at the second level will probably be due to a secondary and subsequent arrangement. It is here interesting to remark that cinnabar has been found to occur in minute quantities with the ore of this mine, as indeed it has in most gold and silver ores of these Indies.

The lode for so far as it has been opened up shows itself to contain many vugs and cavities, this being especially the case towards the two ends. The connection of these cavities with the general water system of the neighbourhood was well evidenced during the passage of an earthquake through the district, when from the bottom level the water, in two places, rose in such quantity that everybody was driven with all speed up the ladders; luckily for the work there was an adit to this level along which the water was able to drain away in a few hours, though springs remained. As the temperature of this water was about 95° F. and as these springs had been in existence though in smaller proportion before the earthquake, it was thought that they were juvenile in origin and that it would be of interest to determine their mineral content by evaporating a large quantity of the issuing water. To the surprise of everyone, before half the requisite quantity had been evaporated, these springs, after the dry season had set in, ceased their flow.

About eight miles away in a direction due east is the neighbouring mine of Lebong Soelit, worked by the Ketahoen company, where the lode strikes in much the same direction as at Redjang Lebong. Its average direction is about N 50° W and the combined length of its faulted portions is 2000 feet, more or less, most of this length occupied by ore with an average width of about 15 feet. This lode stands vertically, in greater part between a northern wall of rhyolite and a southern wall

of andesite, this latter rock being soft and a good deal weathered. The ore mined is a quartz lode, together with a width of the rhyolite wall traversed and impregnated with quartz and mixed sulphides. About 50% of the assay-value is obtained by plate amalgamation, so there is more free gold here than at Redjang Lebong; the percentage of sulphides, while still low, is higher than at that mine, but the presence of selenium is not so marked, nor is the proportion of silver so high, being here only twice that of the gold. It is noticeable that the proportion of silver increases where sulphides are more in evidence, these sulphides being pyrite, galena, and fahlerz. In the case of this mine also, a satisfactory extraction of the metals remaining in the tailing after amalgamation is obtained by ordinary cyanide treatment.

With regard to the distribution of the precious metals vertically, there has been no pronounced difference between the average results of the several levels, though it is the case that the deeper levels have a lower assay-value than those higher up. Horizontally there appears to be a separation into richer and poorer shoots, these apparently being bounded by transverse faults with which they go down in depth.

The third important mine in this district is that worked by the Simau company about 11 miles away from Soelit in a northwest direction. At this place the lode strikes east and west and dips at a high angle to the north. Its outcrop has been traced for about 3250 feet along the greater portion of which profitable ore has been proved with an average width of about 15 feet. The lode consists of quartz deposited in the main fracture together with such portions of the adjacent country rock as are traversed and impregnated with quartz and sulphides. Toward the western end the ore may be spoken of as clean and amenable directly to amalgamation and cyanidation; but toward the east the proportion of sulphides is such as to necessitate the introduction of concentrating plant before the cyanide treatment can be successfully applied. These sulphides consist of galena, pyrite, copper pyrite, and zinc-blende. The present stage of development does not allow any deductions to be made concerning the persistence of ore in depth. The proportion of silver to gold is about the same as at Soelit, and the lode occurs at or near the junction of andesite with rhyolite.

In the Padangsche Bovenlanden, the data available in the case of the Mangani mine show an interesting occurrence. The lode strikes north and south and has been followed for about 2000 feet, of which length, however, the northern 750 feet contain no ore of any value. Along the remaining 1250 feet there are two ore-shoots which have been proved so far for lengths of 550 feet and 300 feet respectively, and between which the lode though well defined contains nothing of any importance. The occurrence of gold and silver ore at this place is centred around a zone of fractures, of which the principal one having a dip of about 70° to the east forms the hanging wall of the lode. Next to this wall comes the richest portion, a width of about 7 feet of banded quartz and rhodochrosite, to which there follows a similar width consisting chiefly of pieces of country rock enveloped and cemented with quartz and rhodochrosite; beyond this again the lode passes through a width of quartz veins alternating with strips of country rock till the more compact foot-wall is reached, this entire structure, as will be evident from a glance at Fig. 3, being similar to that described as occurring at Redjang Lebong. Farther in the foot-wall there is another lode known as the Parallel Reef which generally contains fair silver content though little gold; it consists of quartz and rhodochrosite stringers traversing the country rock along a fairly definite line. This is the position at the southern ore-shoot. Going northward the ore becomes poorer, and at the same time the Parallel Reef approaches the Main Reef. Where these two eventually join and where at the same time an appreciable alteration in the strike occurs, the northern ore-shoot begins, this position being shown in Fig. 4. The junction of the two lodes is marked by the occurrence of a good deal of pyrite in the foot-wall, and it would appear as if at the same time the foot-wall fracture had become more marked while that in the hanging wall had frittered away its precision in the development of smaller fractures, as indicated in the diagrammatic plan of this orebody. The whole occurrence is best described as a zone of fracture, along the course of which the lode-material passes, in alternating and slow curves, from one wall to the other, the ore-shoots occurring where the lode approaches a wall, and the poor parts where it remains in the body of the fractured zone.

The presence of manganese minerals is the characteristic of this mine, these minerals forming about 5% of the weight of the ore; in the upper levels the black oxide is everywhere visible, but lower down the primary rhodochrosite occurs with its delicate pink colouring. The speed with which oxidation of this mineral

takes place may here be clearly seen. In making a cross-cut a vein of the pink mineral traversing the grey andesite may be struck; some months afterwards such a vein will be marked by a black ring around the cross-cut, beneath which the fresh pink of the primary condition can easily be exposed. In the southern ore-shoot the lode-material, consisting of quartz, rhodochrosite, with some calcite, contains little pyrite, and in its primary condition under the level of the ground water the proportion of gold to silver by weight is about 1 : 6, whereas in the oxidized ore this proportion is about 1 : 40. From this it would appear that the silver content occurs enriched in the oxidized portion, while the gold remains unchanged. In the northern ore-shoot, which has practically only been cut in its primary condition, the proportion of silver is again high, this being concomitant with the presence of a considerable percentage of mixed sulphides, among which the silver mineral stephanite is found.

The experiments which have been made to determine the question of the proper treatment of this ore have shown that about 20% of the gold is to be obtained by ordinary amalgamation, and that from the remainder a satisfactory percentage may be obtained by ordinary cyanidation when the material has been ground fine enough. With regard to the silver the determination of this question was not so simple; it was found that with the oxidized ores very inadequate extractions are to be obtained by straight cyanidation. By giving the material however a preliminary chloridizing roast or by treatment with hydrochloric acid, the particular combination in which the silver finds itself becomes dissociated, the silver entering a new one more amenable to cyanidation. This was also found to be the case after roasting with sulphur or after a preliminary wet treatment with sulphurous acid. All of these treatments were however considered economically inapplicable. When in the course of deeper development primary ore was encountered, this was subjected to the same experiments, with the result that whereas the oxidized ore would only yield about 20% of the silver to ordinary straight cyanidation, the primary ore could be made to yield 80%. These facts are stated here as they give an indication that the silver appears in its primary condition to be bound up with the manganese in a compound which when oxidized leaves the silver in such a state that it is either protected from the action of the cyanide solution or is not soluble in that solution. This condition of the silver is particularly interesting in view of the fact that it is paralleled under similar geological circumstances in Mexico.

In the case of the Salida mine the outcrop can be followed to places 1800 feet apart, over the greater portion of which it may be said that the total content in gold and silver would allow the ore to be worked at a profit, the value being about equally divided between the two metals. This lode is about 20 feet wide and stands more or less vertically between andesite walls. In the same neighbourhood there are other parallel lodes, though no one of these has yet been shown to contain any ore-shoot. From the upper levels of this mine the records of the old East India Company show that a good deal of very rich ore was taken out. The development work which has been done in recent times does not indicate that the lower levels will provide comparable amounts of similar ore, though the presence of a large body of lower-grade has been established. Since also the presence of ruby silver ore was reported with the rich ore in the upper levels, and this is a mineral which is held to be characteristic of the zone of secondary enrichment, it is probable that the high assay-values in those levels were due to such enrichment. The ore at present found in the lowest level may be set down as representing the value of the primary deposit.

In general the ores which have been described as occurring at the various mines mentioned bear a great resemblance to those of the Waihi in New Zealand, and to those of the El Oro and Esperanza in Mexico, a resemblance which is emphasized by the great agreement between the geological circumstances in which they all occur.

It now remains to describe the occurrence of gold and silver ore in connection with the alteration of limestone in the southeastern corner of the Tapanoelie Residency. In this district the limestone can be seen capping many of the hills and scattering the slopes with its debris. It is further seen that it occupies so regular a horizon, that from its position on any one hill its position on the opposing hills can very well be projected. In general the intervening valleys cut deep into the granite base upon which the limestone found its bed at the time of its original deposition. These facts practically put any idea of the intrusion of this rock into the limestone out of the question. It is seen, however, that not all the valleys are in granite, but that in places the breaking of the surface upon the steep flanks exposes a subsoil of such red colour as must

come from a much more basic rock. Such occurrences mark the tracks of diabase intrusions, which in general here strike a little north of west and south of east, maintaining a great width over a long length. Were the granite alone responsible for the alteration of the limestone and for the formation of ore, then the area over which such ore would occur would be so large as to allow little hope of any concentration to form a profitable deposit; but, in fact, the occurrences of ore are much more local than that, and it is probable that they will be proved beyond doubt to have a near relation to the diabase intrusions. This is likely first of all because lodes containing gold and silver have been opened up under European supervision in these intrusions—such lodes also having been worked for ages by the natives—and also because at the place where the ore deposit between the limestone and the granite appears the most promising, there is evidence that the occurrence is situated between two parallel intrusions, this situation offering a double entry for the mineralizing solutions along the line of contact.

The gold and silver ore within these intrusions themselves is found in small quartz veins and stringers which carry a good deal of pyrite, mispickel, and lollingite, this latter occurring in characteristic needles. With regard to these veins it has been the experience so far that the encouraging assay-values, which have been obtained near the surface, have not been maintained in greater depth. Near the surface, however, the natives have worked these veins a good deal, having found that the decomposition of the sulphides has left the ore in a condition which allows the gold to be easily obtained after grinding by washing.

It is interesting to remark that though in general Sumatra is densely wooded, allowing but rarely an outlook over the country to be obtained, this is not the case where limestone or granite come to the surface. In such places long grass with small bushes not high enough to impede the outlook occur, and magnificent views are to be had from the hills. The country is also exceedingly pretty where the valleys are under cultivation for the production of rice; the climate is healthy and, up in the hills, not too hot to impede work; in the districts concerned the natives also are friendly, intelligent, and clean, all these circumstances making mining in this country as agreeable as possible, though prospecting work is hard. The interest taken by influential people in Holland and the Continent should lead to an expansion of the mining industry of the island.

## Russian Platinum in 1911.

Owing to the high price of the metal, the production of platinum in the Urals increased during the year 1911, as also did the exploration and development. By far the most important producer in the Southern Verchotur district, where the Nijni Togil properties are situated, and also those of the Platinum Company. The production during 1911 was 121,300 oz., being an increase over 1910 of about 10,000 oz. The adjoining Northern Verchotur district produced 11,375 oz., which is a slight decrease as compared with 1910: but the decrease is only temporarily and is explained by the reduction in the amount of work done at the Southern Zaozersk Estate, belonging to the Trans-Ural Mining Company, due to a shortage of labour. The other two producers in this district, the Dyalinsk and the Nicholaieff Pavdinsk, compensated by producing more during the year than in 1910. In the Perm district, the production of platinum during 1911 was 46,873 oz., an increase of 7900 oz. as compared with 1910. In the Southern Ekaterinburg district the only producer is the Systersk Company, whose yield for 1911 was 1100 oz. The Northern Ekaterinburg district produces practically nothing. The Tcherdinsk district is also a negligeable quantity. The total production for the year was 180,400 oz., as compared with 176,120 oz. in 1910.

The above quoted figures are official, and relate to the production reported to the Government of Russia; but the official figures are notoriously incorrect, for large amounts of platinum are produced and marketed without being reported, by people who desire to avoid the tax. The official figures for the production during the last ten years are here given, together with an estimate of the real figures:

| Year | Official figures oz. | Estimated total oz. |
|---|---|---|
| 1902 | 197,000 | 380,000 |
| 1903 | 193,000 | 226,000 |
| 1904 | 162,000 | 290,000 |
| 1905 | 168,000 | 200,000 |
| 1906 | 185,500 | 210,000 |
| 1907 | 172,000 | 310,000 |
| 1908 | 157,000 | 250,000 |
| 1909 | 164,500 | 275,000 |
| 1910 | 176,100 | 300,000 |
| 1911 | 180,400 | 300,000 |

The price of platinum has steadily risen during the last 2½ years, from a level approximately equal to that of gold to rather more than double. The rise is due to increase in demand, rather than to any 'corner.'

# DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

## The Finance of a Mine.

The Editor:

Sir—Mr. M. H. Burnham's articles on the 'Finance of a Mine' raise a number of interesting and important questions. Specialists in these subjects will scarcely agree with his views on many points, nor will they be disposed to accept many of his theories and formulas as either sound or of any practical utility.

The title chosen clearly directs discussion more particularly to the subject of finance rather than to the technique of mining engineering. Viewed from the standpoint of practical finance, Mr. Burnham's numerous tables and mathematical formulas appear to me to be for the most part fundamentally unsound.

He begins with a somewhat bold assertion that "the sound estimate of the value of an investment assumes not only the return of capital and 3% annual interest, but a numerical allowance of interest for the risk of loss." He then develops from this his 'risk-rate' principle. It may be doubted whether the mining financier or investor, who by the way may be credited with knowing something about investment, bases the conduct of his affairs on any such assumptions. The term 'risk-rate' for the rate of interest which may be derived from a speculative investment, such as mining investments undoubtedly are, is a most unfortunate one and seems to me to imply a grave misconception in regard to the first elementary principles of speculative finance. Yet on this so-called 'risk-rate' principle Mr. Burnham builds up his whole theory of mine valuation and finance.

The value of a speculative investment depends primarily and principally upon the prospect of gain, whereas the risk of loss is nothing more than a secondary or modifying factor. The gain may come by way of an increment in capital value at any time, even suddenly or unexpectedly as a result of one or more of the many factors which are operative in connection with all mining work. The possibilities of rapid capital increment are necessarily reflected in the rates of interest yielded by mining investments. These rates are frequently much lower than might be expected at first sight when one compares the nature of the security with that afforded by many ordinary industrial undertakings. I may illustrate the point by reference to the case of the Talisman mine which has already been alluded to in the magazine. The last dividend declared worked out at 13% on the market capitalization. Setting aside 5% as clear income and 8% compounded at 4% for capital amortization, the expectation is 10 years at the present rate of profit output. The security, as represented by the profit in the ore reserves, is only 1·4 years output. A conclusion which might be drawn is that the public are prepared to accept about the same rate of clear income from a medium class of gold mine on the basis of a fairly long expectation of life as that yielded by, say, the bonds of a South American Government or a medium class of industrial security. The possibility of something more or less sensational taking place at the mine, such as may increase capital value, might be regarded as offsetting the superior character of the security afforded by the Government bond. This mine may be much overvalued; if so, it is certainly not unique in this respect. But the fact remains, nevertheless, that the majority of metal mines are not and cannot be valued on interest rules and considerations alone or on the basis of the tangible security afforded to the capital invested, that is to say they cannot be valued on the risk of loss.

The superior importance of speculative attraction and the very much smaller importance of risk or degree of security in speculative finance is clearly illustrated by Mr. Burnham's Table IV. The profit in the ore reserves at St. John del Rey, which is now the deepest gold mine in the world, is shown there to be greatly in excess of the market capitalization. The long history of this great mine, however, especially that of its later years, denudes it of any high degree of speculative attraction and the market capitalization is therefore correspondingly low, though the tangible security is relatively high as compared with that afforded for instance by the Abosso and the Prestea. Dolcoath, the deepest tin mine, paid 17% dividend last year, yet the shares stand at a discount, though the resources of this ancient mine are still enormous. But here again its history deprives it of nearly all speculative attraction. On the other hand the recent Nigerian boom clearly demonstrates, though in an exaggerated manner, the overwhelming importance of this attraction as the basis of investment valuation in the sphere of speculative finance. If the risk of loss were such an important point in matters of mining investment valuation as Mr. Burnham would lead us to suppose, then I venture to suggest that the

mining industry would be in a perpetual danger of slow extinction.

Mr. Burnham's methods of applying his 'risk-rate' principle are equally unsound from the financial standpoint.

Tables VI, VII, and VIII, Formula VIII which reads:

$$D = (1 + r' + r''')^d \left(r' + \frac{r'}{R^{hy} - 1} + r'''\right)$$

and the present values marked on Fig. 6 all embody what is commonly called in actuarial circles 'Hoskold's fallacy,' which is that higher rates of compound interest are used for purposes of calculation than can be realized in the sphere of practical finance.

Compound interest at speculative rates implies the unbroken serial success of strings of speculative transactions, which is a contravention of probabilities. It is scarcely necessary to remark that a method of calculating monetary value which is based on these unpractical assumptions and unattainable financial conditions can only give unreasonable and misleading results. It is by such methods as these, however, that Mr. Burnham proposes to "present the assets in adequate simplicity to the financier."

Mr. Burnham's method of determining the 'present value' of blocks of ground is financially unsound from another point of view. These blocks are not called upon to yield speculative rates of interest on capital during the period pending the realization of their contained values, and to calculate their value on such lines is consequently not in accord with the principles of sound finance. It must always be remembered that money is essentially a medium of exchange and symbolic in character. The monetary conceptions in any rational system of finance must therefore be adjusted to meet the actual and necessary circumstances conditioning the production and exchange of wealth. The function of a block of ore is to yield up its wealth in due season and to contribute for that time its share of the dividend on the total capital invested. This is how it is regarded in the standard practice formulas for the determination of present value. Compound discounting at high rates of interest gives in effect a forced liquidation or breaking up 'present value' rather than the value of an undertaking as a going concern, which is the basis on which financial transactions would normally be conducted.

Mr. Burnham gives a formula for shoot-extension applicable to the 'typical ore-shoot,' whatever kind of shoot that may be, which he says is a simple statement of what constitutes sound practice in estimation. No attempt is made to show how this formula has been deduced, but it appears to be based on quite a wrong application of the principle that the risk or probability is in proportion to the known data. This formula and the subsidiary formulas V and IX derived therefrom, in my opinion merely beg the question which they affect to answer. The risk-rate, $r'''$, for the "standard block" is to be arrived at by sampling ore known to exist as the result of development work. This is integrated in the extension formula, and, according to Mr. Burnham, limits the extension allowable below the bottom level. There neither is nor can be any necessary mathematical connection between the risk attached to the realization of profits from ore, the existence and value of which have been demonstrated by sampling and development on the one hand, and that attached to ore the very existence of which is the principal question at stake. There are in reality no certain positive 'known data' in regard to the state of affairs below the bottom level. Surely this is the point of the old Cornish adage that it is impossible to see beyond the pick-point. The geological evidence is clearly the only real guide to the mine valuer in matters affecting any allowance for shoot-extension. This shoot-extension formula is therefore in my opinion mere mathematical nonsense, and it is not easy to see any reason why these fantastic methods of valuation should supplant our old nomenclature of 'positive' and 'probable' classes of ore.

Mr. Burnham appears to be obsessed by the ideas of risk and "the essential soundness of the deferment principle" to the detriment of other much more important matters. His whole philosophy of valuation is based on attempts to estimate possibilities of loss, rather than giving first and foremost consideration to the prospects of gain. This fundamental misconception in regard to the value of a speculative investment, coupled with financially unsound methods of calculating allowances for deferment, render Mr. Burnham's mathematical methods of valuation useless for all practical purposes.

Mr. Burnham expresses some peculiar views on the valuation of base metal mines. One can agree with him that, in the problems of base metal mine valuation, how "to allow for variation in the selling value of other metals than gold is worth more than a passing thought." His discussion of the subject, however, is not illuminating. It is indeed difficult to extract

one iota of useful information or to make any sense whatever out of Mr. Burnham's writings on this subject. No attempt is made to indicate the rationale of the formulas given, nor how the constants $n$ and $k$ are to be determined by experience. The "mean selling price" of a metal is anything according as it may be calculated, and finally the formulas only affect to give the probability of loss. It might be interesting to know what is the kind of experience by which these marvellous constants are to be determined. Is it experience in gambling, in the vicissitudes of underground mining, in metal market transactions, or in the idosyncrasies of company directors that is required? What is meant by "the ordinary probability law?" There are plenty of 'probability laws.' And how is it to be derived so that it may be considered as possessing the necessary degree of credibility as applied to base metal mining? In the meantime we must rest content in the time-honoured custom of carefully studying the industrial outlook and signs of the times, when forming judgments as to the worth of base metal mines.

W. H. GOODCHILD.

London, April 22, 1912.

The Editor:

Sir—If personal equation be allowed expression for a moment I would beg to express my thanks to the many who have commented on my papers, and notably so to Mr. S. J. Truscott and Mr. H. S. Denny, the breadth and moderation of whose views are in keeping with their Rand experience. Mr. Ross B. Hoffmann's letter too has my special appreciation, as it shows a close study of a phase of the problem, though one perhaps usually taken for granted by those familiar with the basis of Rand deep level valuations; this will be touched on later.

The inwardness of these communications is of more than passing significance, however, as with the exception of Mr. Denny's letter all show a disregard of the principle of probability, and what is more serious, controvert the one dictum of modern science, which is that every effort should be made to eliminate so far as practicable the purely personal element; in other words to collect and present data in such amount and manner as shall enable others as well as the one collecting to make their own deductions.

Further, practically the whole of our scientific education as well as business enterprise is based upon the application of the law of probability, the essential of which is a series of observations or investment. So much for generalizations! In practice no trained engineer multiplies 2·1 by 2·12345, knowing that the principle of significant figures precludes the expression of figures beyond the second decimal place. But both in valuation and operation our sampler's accuracy may be compared with the figure 2·1 and that of the assayers with 2·12345. The justification for the extra expense of such accuracy is the greater elimination of the variable human factor. The Hoodoo stick is essentially unscientific, not because it is necessarily inaccurate, but because its rationale is at present beyond the understanding of the trained ordinary intellect.

We use our refined formulas for calculating stress and strain in beams only to multiply by a 400 or 1000% factor of safety; evidently not accurate but most sound if we be of the scientific faith; if we seek to reduce the probability of error due to the 'inspiration' regarding its strength. So our 'inspiration' methods of valuation are necessarily at variance with our technical training insomuch as the essence of the latter is a full presentation of data and methods of deduction, this being the only scientific method.

Reverting now to the application of the probability concept in business life, I cannot do better than to cite the case of a recent shipwreck and loss of bullion insured to the value of £700,000 upon which a premium of only £500 was paid. Superficially examined this small premium showed poor business ability on the part of the underwriters; in reality doubling it would have made no appreciable difference. The essential point is that, in mining, insurance, or other commercial industries, speculation becomes scientific providing the number of ventures is sufficiently extended and the personal equation is largely eliminated.

Evidently the thing necessary to give mining a place, something more like that we should like it to occupy, is a series of ventures and the scientific habit of mind on the part of valuers. From this point of view the larger financial concerns may be said to be usually sounder than a single mine, but only on the condition that the individual element on the part of the engineers and directors is reduced as far as possible. It will be seen that I do not agree with Mr. Denny's finding that mining may not be regarded as an investment. On the contrary, I am strongly inclined to believe that if mining were carefully studied with reference to the amount of cash capital as distinct from nominal capital, especially with regard to those undertakings where the scientific habit

of mind was observed, a surprisingly favourable showing would be made. And were any engineers suitably grounded in financial analysis to undertake the task, I feel sure that the result of a comprehensive study would be most enlightening and confer an equal benefit on the whole mining community. Also with Mr. Denny's apparent inclination to regard prospects as specially hazardous I am disposed to disagree, providing always that a series of investments be contemplated and the engineers be suitably trained. In fact, because cash payment to vendors is seldom made in the case of prospects and usually in that of developed mines, I am inclined to think that a better showing would be made by the former when reported upon by qualified men. Unfortunately, however, flotations of prospects are nearly always made on the reports of prospectors ; in fact a curious cowardice characterizes experienced engineers with regard to the valuations of prospects, they usually being so fearful of failure as to unreasonably condemn good showings. Yet as every insurance business shows great losses so must the really sound engineer face many failures in the case of prospects. Where an engineer has the intelligence to see, the courage to admit, and the character to demand that the terms of payment form an integral part of his recommendations, I believe that the major part of mining failures would be eliminated. Before turning to Mr. Hoffmann's paper let me venture to again emphasize the point, overlooked by most, that a high risk-rate is but a diminished present value; that a low present value or smaller investment leaves room for the next step, further adventure, that is, the series of events essential to the probability concept forming the basis not only of physical science but of business life.

At the risk of appearing ungrateful to those who have honoured my articles with so intelligent an interest, I cannot forego cavilling at their failure to approach the subject in a more scientific mind, as for example in accepting or rejecting the premises and corollaries seriatim as set out in Article VI.

The method followed, that of controverting a single statement without giving the premises which the critic accepts or rejects, renders a satisfactory reply impossible ; all that may be attempted in the way of answer must be based on an inference as to the critic's premises, a sufficiently unsatisfactory position.

I will now take Mr. Ross B. Hoffmann's letter. His first point may be summed up as traversing the principle underlying the valuation of the standard block, basing his dissent upon what he regards as an error in the allowance for risk, namely, that the amount of the present value written down or 'cut' for each unit of annual profit is a function of the delay in realization (deferment). This is an excellent example of the strange detachment of the mining engineer from the practical business world ; it at least shows a neglect of the principle underlying its commonest practices. To illustrate, taking the case of a banker lending to another bank at say 3% per annum and to an individual at 5%, we may say that the difference in the amounts collected would go into a reserve fund from which any losses would be met before dividends were paid. When a banker discounts a man's bill his action is much like that of taking the present value of a block of ore, for the amount realized above that had from discounting a bank's paper is made a function both of the risk and of the time. In other words the contribution to the reserve from which losses are met is greater the longer the loan remains with the individual.

These are the broad facts of ordinary commercial life, and to conformity with the latter mining valuation must be brought, if the tenets of the scientific faith, so persistently taught in our technical schools, are to be observed. From the foregoing it will be seen that, allowing for different methods in calculating present values, the differences set out by Mr. Hoffmann's table are in accordance with banking practice. The latter may be said to read that the greater the time elapsing before the principal of a loan is repaid, the greater the number of events which may happen to bring about loss ; hence the practical provision to meet it by levying a corresponding contribution to go to the reserve from which to meet losses.

Mr. Hoffmann's table on page 216 may be said to express these allowances for probable loss for different times of delay (deferment), yet he would seem to have overlooked the underlying principle.

In the two examples given on page 215 the different cuts or discounts for identical standard blocks is 9·2% for the one delayed 2 years and 37·8% for that delayed 10 years. And yet Mr. Hoffmann would seem to think it unreasonable to ask for a special allowance whereby to meet the number of untoward events likely to happen in eight years. As seen above, the banking world disagrees with him ! In the case of the two standard blocks of equal deferment and risk-rates, Mr. Hoffmann appears to confuse the unit of annual profit which is cut with the physical unit set for defining

our factor only of this cut. The standard block is really one with a given ratio of perimeter to volume, and may contain few or many units of annual profit; and while each of these last units would be cut equally in the above case, the physical dimensions, not being units in the sense indicated by Mr. Hoffmann, are unaffected. As repeatedly pointed out in the leading articles of the magazine the actual value of a mine or a block of ore is unknown and unascertainable; we must seek to estimate its probable value, which is all that may be done in any business undertaking. The error in a valuation is the difference between this probable value and the imaginary real value and is a function of the number of observations, otherwise sample sections. Each section, except by merest chance, must vary from the mean value, perhaps greatly, this variation being the error of that observation. But Mr. Hoffmann takes two hypothetical errors, one of 22% and another of 70%, or a mean of 46%, and expects that the allowance of 37% will cover each case. This is similar to the Cornish mine captain who disbelieves in mine sampling because two samples taken by him show so great a difference from the mean value of a block as afterwards determined by a crushing. As repeatedly dwelt upon, all our so-called accurate work is but an attempt to minimize the error due to the personal factor and the effort to balance the plus and the minus errors by a large number of observations. For instance, given a block of ore having a mean gross value of £4 per ton and a so-called average cost of £1 per ton. Neglecting losses we say a profit of £3 per ton, accepting without comment that one sample section may run £20 and another 10s., the one showing a large profit for that particular portion of the block and the other a loss on its corresponding part. Again the costs will often vary largely for different parts of the same block, due to pinching of the walls, favourable or unfavourable fissuring, etc., while the shovelling and tramming costs will vary over wide ranges. Yet in spite of these manifest inaccuracies in an estimate of average cost for a given block, we couple them with the equally manifest variations in value, hoping that the realized profit will approximate that of our estimate. But we find this result to be a function of the homogeneity of the block and the number of observations. The risk-rate cut, like the profit from a block, is an allowance aiming to cover a number of inaccuracies, and like the same thing in commercial life, the contributions to the hypothetical reserve made by each block are made a function of the time, though this last is but a convenient manner of expressing the idea that the accuracy of our judgment or amount of necessary data varies inversely with the time. But as used by me, the risk-rate, as applied to other than the standard block, is also made a function of the data, hence is similar in principle with the discount for time made by the banker. This brings out the internal and external factors making-up the risk-rate, which will be dealt with at greater length in a book on 'Modern Mine Valuation,' now in the press of Messrs. Charles Griffin & Co.

The gist of Mr. S. J. Truscott's letter is that he admits the logic (page 59) of taking the present value, having regard for the time of exhaustion of each block and for the difference in risks between positive and probable ore. At the same time he finds that the principle of taking the present value of a series of uniform returns as a basis of valuation is equally valid. This would seem as unsound in principle as to content oneself with a single sample in valuing a block of ore, for it is an axiom of all exact measurement that the greater the number of weighted observations the nearer the probable value approaches the real value. Again, what annual rent does Mr. Truscott expect? This is the crux of the matter, that is, the adjustment of the risk-rate or the theoretical yearly contributions to a reserve fund, which shall provide for the inevitable plus and minus inaccuracies in valuing each block. This failure to mention the annual rate of interest to be used is an unfortunate oversight on the part of Mr. Truscott, but one which we can hope he will remedy. On the whole, while he admits the general principle as sound, he would seem to vacillate between the attractiveness of theory and the conventions of practice; the latter ever lure him back.

Mr. Truscott questions there being purchasers of mines based on the value of the positive ore. While this is unfortunately true of many gold, silver, copper, and tin mines, they figuring as more convenient counters in share gambling, yet in iron and coal mining, in other words, where economics hold more general sway, the above valuation based on positive ore is the rule. If, however, Table IV. of Article III. be referred to, it will be seen that, even with promotion profit included, the capitalizations of the Alaska Mexican and Alaska United mines call for a shoot-extension of 20 and 26 feet only; a negligible quantity. So even in gold mining one finds economics to have occasional place in practice.

Reverting to Mr. Truscott's comments on

the idea of a standard block for each shoot, he would seem to have gained the impression that I advocated the subordination of mining necessities in the matter of block dimensions to accuracy in sampling. In Article II. it will be seen that I expressly stated: "the exigencies of mining largely determine the distance between levels and connections"; again "*consciously* or *unconsciously* we have to decide on the dimensions of a standard block." Surely it were clear that no demand was made for the actual blocking out of the ground in a certain manner, in order to have standard blocks, though in fact this idea governs development to a greater degree than is realized.

To emphasize this perhaps unconscious concept of a standard block, the dimensions of which will be determined by the local character of the 'pay-ore,' we have only to ask if, in districts where the shoots are only 200 ft. wide, we would consent to cube and value a block 1000 ft. long showing good assay-values in winzes at either end, but unsampled along a connecting level. Again we may ask if, where the habit of the 'pay-ore' is to run in sills, as for example when a vein cuts various productive and barren andesite flows, we should allow full value for a block sampled on two levels but without connecting winzes, the levels showing good values but the distance between them much greater than the general habit of the known sills or flat shoots. We have only to expand these imaginary dimensions when dealing with a particular case to see how common the concept really is, the only novelty offered by me in this narrowing of the idea, so to speak, this calling for a detailed study of the assay-plan, having sample sections closely spaced, in order to bring out the habit of the pay in each shoot.

M. H. BURNHAM.

London, April 30, 1912.

The Editor:

Sir—The discussion now proceeding in regard to the recent series of articles on this subject by Mr. M. H. Burnham appears to me to deserve closer technical attention by those engineers who have undertaken to comment. While Mr. Burnham may have erred in covering too wide a range of his subject in so condensed a form and in so highly technical a manner, it is regrettable that, with the exception of your leaders, the majority of criticisms have introduced a personal controversy which might well have been omitted in the discussion of so important a matter. The main underlying principle seriously recognized, whether it be a mine or any other speculative business, is that a substantial allowance for risk must be made which should be apart from any personal equation, such as in the case of those prophetic geologists who claim to be able to see farther into Mother Earth than their *confrères* and who have, we know, too frequently found themselves deplorably at fault in respect to future developments and valuations. The application of a risk-rate as set forth by Mr. Burnham to allow for variations in assay-values in only partly developed blocks of ore separately from those which have been mined on four sides appears sound, and it is obvious that some method of applying such a principle is consistent with ordinary business practice. It is true that this may not suit those valuers who wish to curry favour and position with a certain class of financiers—but that of course is another matter.

L. H. WEBBER.

London, May 4.

## Economics of a Boom.

The Editor:

Sir—I take pleasure in complying with your wish that I should state my views on the economics of mining booms.

As the aftermath of every boom and slump in a particular department of the mining market, there is a flood of lamentation over the shrinkages in market-value and the enormous losses that have consequently ensued. Even the oft-repeated palliation that a minor amount of stock changes hands at top prices is quite superficial from an economic point of view.

In order to get at the true position, it is necessary to disassociate clearly the various elements that are involved. The first of these elements is the actual industry in the given mining region upon which a boom has been built, and the second is the people at the financial centre who are engaged in the provision of capital for this industry. These people must be divided into two classes: the Insiders, who provide the capital, namely, the promoters, brokers, etc., and the Outsiders, who may be styled the investing public, although they often enough consist of other promoters and brokers. These classes could perhaps be truly styled the producers and consumers of mining shares, or in more formal economic terms, the *entrepreneur* and capitalist.

It may be stated at once that the actual capital invested and risked in such a mining industry has nothing to do with either the nominal, issued, or market value of the shares

of companies operating in a given region, but is what we may style the economic investment and consists of :

*A*. The actual working capital and materials shipped to this given mining region and there devoted to plant, machinery, development, management, etc.

*B*. The expenditure in the management of these companies at the financial centre, such as directors, secretary, engineers, registration fees, office expenses, advertising, etc.

*C*. The amount of money expended in the raising of this capital. This sum is one difficult to estimate, for, from a social point of view, the promoter, broker, etc., must be supported by the industry and the 'economic' outlay upon them is only the amount of their takings from the investor or the industry that they do not re-apply to reproductive investment. If they live modestly and continue to labour this wastage amounts to very little ; if, on the other hand, they squander their takings, it is in such proportion more important. This sum bears little or no relation to the games of paper-trading which may be done as between the two parties at the financial centre. The Insiders may make millions of such paper and sell it to each other or to the Outsiders, but this, except for the economic expenditure, is simply taking a block of the national wealth from the pocket of one individual and placing it in that of another. Further, the matter somewhat hangs on the question as to whether we look at it from a world's view or from the more narrow national view. In the latter case, if the promoter or vendor be a foreigner and removes his takings from the country, then these sums would constitute a part of the economic expenditure. This is not so, however, from the broader view of total world's wealth.

The economic investment then consists of the sums represented by *A*, *B*, and *C*, and if the net returns from the metal produced in this given mining region show a profit on this economic investment, then the national wealth has been increased. By profit, I mean necessarily the return of this capital with interest.

In order to make the matter clear, we may take a hypothetical example. On the Blank mine the '*A*' expenditure, that is, the actual development and equipment and management on the ground, is, say, £100,000. The '*B*' expenditure on the registration of the company, directors' fees, secretary, etc., is £5000. The '*C*' expenditure is extremely difficult to assess. It may comprise the living of one or several promoters over a longer or shorter period, and a part of the living of several brokers and jobbers and their satellites. To arrive at a figure, however, we may assess this at £15,000. We have therefore a total 'economic' investment of £120,000. It is quite possible that the Blank mine may be capitalized at £1,000,000 and that the Insiders may sell the shares to the Outsiders at that figure, but the £880,000 representing the difference —if we assume that the mine should fail absolutely—is not itself an economic loss. It simply means that this much of the national wealth was transferred from one individual to another. It might result in a decrease in national wealth if the £880,000, or any part of such purchase of the mine were removed from this kingdom. It is quite possible to say that the Insiders may spend more than the £15,000 upon legitimate living or on riotous extravagance, and that they may never again perform any labour, so that a portion of the £880,000 does not return for re-investment in reproductive work, but, in any event, experience shows that it is a minor quantity. Further, from an economic point of view, this £880,000 of capital in the hands of the Insiders is often invested to more reproductive purpose than if it had remained in the hands of the idiots who parted with it. We can assume many alternatives ; for instance, that the Insiders succeeded in selling only £120,000 worth of these shares to the Outsiders. The enterprise would show a shrinkage in market-value of one million, but even the Insiders would not have benefited by the transaction ; or we can assume that the enterprise returns the £120,000 and an additional £100,000, in which case the national wealth has been increased, although there was a shrinkage of £780,000 in apparent value ; we can also assume that the mine proves worth £15,000,000 or any other handsome amount—on this occasion.

The reasoning may be extended to the recent case of the Nigerian tin boom. At the maximum point of the market enthusiasm for this industry the total nominal capital of companies involved in that region, so far as I have been able to determine from available material was, in round numbers, £5,200,000 ; of which there was issued about £4,400,000. The total of what may be called the market-value, that is the quotation multiplied by the number of shares of the companies involved was about £10,700,000 ; and the total working capital (omitting cash payments to vendors) provided for these companies was about £1,100,000. Such a bare financial statement, however, requires a large amount of re-adjustment. Many

of the companies hold shares of other companies, and thus there is a good deal of duplication in such figures. Any proper adjustment is impracticable as the holdings are not sufficiently known. I would not be surprised, however, if it were found that upwards of 30% should be deducted from all the figures for this reason. If we assume that there is fairly assured a total output of 50,000 tons of black tin from properties now known, and that this metal can be recovered over a period of ten years, there would be on known results a profit of roughly £2,500,000. Such a sum would have a present value, if discounted at 7%, of about £1,875,000. It is, of course, possible and probable that more tin will be found than that mentioned.

Now as to the 'economic' expenditure on this industry we can be certain that the actual working capital available for administration and work at the mines does not exceed £1,100,000, and out of this comes, not only the '*A*' expenditure, but a large part of '*B*' as well, namely, directors' fees, etc., are paid out of the working capital; in some cases registration and promotion costs are met without entrenching upon this, but such an allowance can be neglected as the sum mentioned embraces the working capital of preliminary syndicates and finance companies. In any event, it appears to me that this figure of £1,100,000 is a liberal estimate for the '*A*' and '*B*' portion of the 'economic' investment as the industry is now constituted. It is not necessary to include in the 'economic' investment the cost of railways and commercial establishments, because those concerns should have returned their capital from the working costs of tin production and from the development of the country in other directions. The '*C*' expenditure it is, of course, impossible to assess. One can only say in a general way that the promoters of Nigerian tin mines are most of them active and energetic men who live in a modest manner and do not buy undue quantities of jewellery for their wives; moreover, but few of them possess more than one motor car and no steam yachts have yet been announced. Therefore we need not take the gloomy view that they will retire with the money they have received, becoming drones on the community, or establish families of drones, or squander it in riotous living. The more hopeful view is that they will re-invest their takings in reproductive work and continue to devote their experience and abilities to the augmentation of the national wealth. The actual sum of wastage therefore through this item is not likely to be large. Moreover there are only about 32 companies having a working capital in excess of £15,000, so that these gentlemen cannot be a very large body or of very large ideas. Between a rough valuation of £1,875,000 for the industry "in sight" and the £1,100,000 mentioned we have a margin probably greater than the actual wastage involved on the '*C*' account. For all of which reasons it seems probable that Nigerian tin will show a sound profit from a national point of view. And should the actual industry expand the favourable margin will be greater.

It must be borne in mind in considering any particular economic current, that there are many side streams, the introduction of the details of which only confuses the main outlines. For instance, a considerable proportion of the expenditure under 'A' and 'B' will be saved by officers and employees from their wages and salaries, and a considerable portion of it will be expended on machinery and plant, and the manufacturers and workmen of this equipment will save a portion of this money, the whole of which savings may return to reproductive expenditure and should, from a point of view strictly of national wealth, be deducted from the 'economic' expenditure. It might also be said that the money paid to the Government in stamps (which probably amounts to £50,000) is not entirely economic loss, as such contribution to the general taxation entails a less heavy drain from other quarters. And, furthermore, some of the Government expenditure may be reproductive. There are many other items of this sort and I draw attention to them lest some wise person arise to state that I have not considered these hundreds of economic rivulets that feed the main stream.

There are many psychological factors in any boom, one at least is often put forward as of some consequence, and that is the economic value of a speculative fever. For instance, Nigeria possesses mineral wealth worthy of development, and the securing of adequate capital is made easier by such a fever. It is true that all those of experience realise the great difficulty in securing adequate capital for new industries where such a fever does not exist, and it is a fact that the '*C*' expenditure on promoters, brokers, etc., is greater without such a fever than with it, for more intermediaries must be employed. In such cases 99% of the capital raised comes from persons who buy shares not on any knowledge of the enterprise beyond its market nickname, but because of the fullness of hope that they

may re-sell the shares to some other outsider on the following morning at a higher price. Given that this person is capable of conviction as to the merits of a given enterprise, the cost of convincing him outside of boom hours is very great; it usually takes years instead of days, and an army of intermediaries instead of a troop. On the other hand, and of greater importance from an ecomonic point of view, is the fact that in boom times a multitude of worthless ventures are started; these represent a great economic loss, which would not in other circumstances ever have arisen. Thus, out of the £1,100,000 provided for Nigerian mines, probably more than half is for companies destined before their birth to early and complete extinction. This wastage amounts to several times the amounts saved in more economical finance as set out in the first part of this paragraph.

If we wish to extend the application of these principles to the various mining booms that the London market has experienced, we could say with some assurance that the Witwatersrand and Broken Hill have been most highly profitable mining districts, and that the national wealth was greatly increased thereby. We could also say that from anything now known West Australia, West Africa and Rhodesia will probably result in economic loss. We could also say that from the point of view of the English investor alone, Russia, Spain and Mexico probably show a profit, but that the United States, Canada, Queensland, South Australia and Victoria, and South America generally show a loss. Obviously, it does not follow that individual enterprises in those unprofitable districts may not have been abundantly successful and in every way justifiable.

H. C. HOOVER.

London, May 7.

[In regard to the sequelae of a boom, we can state that Mr. Hoover is slightly in error, as the motor-car and the yacht stage of prosperity has just been reached by one or two of the Nigerian operators.—EDITOR].

## In Chihuahua, Mexico.

The Editor:

Sir,—The condition of affairs in Chihuahua is, I take it, of interest to a number of your readers, and as I left there on April 13 and had been over a considerable portion of the State during the previous six weeks, the following notes may not be out af place.

The revolution is against President Madero. What the reason is no one seems to know. I questioned several of the revolutionists in this manner: "What party are you?" "Oh! Liberals." "But why are you fighting?" "We are against Madero." "But why?" "He is not a Liberal, but look at my lovely rifle." This is a typical conversation. I asked these questions two months ago, and all the time till I left the country, but in all cases the answer was invariably the same; the real fact being that the men are out for loot and private revenge. The mines are being shut-down as soon as their stores are finished, thus more peons are put out of work, and they also go on the rampage. The few federal soldiers in the State are kept busy with the larger bands of revolutionists, and the smaller bands are left to murder and rob at their sweet will. This makes it bad for the rancher or miner who is some distance from the larger towns; he has to be on the look-out day and night. The towns, on the other hand, offer splendid opportunities for the larger bands. I will give you an example of the lonely rancher and the larger town. At La Playa de la Cruz lived a man named Villanueva with his wife and two children. He had a reputation for being rich and keeping money in the house. One night some men came along and were given food. In the morning the man, woman, and the two children were found brutally murdered. Many of your readers will know Parral. I arrived in Parral on April 11 unaware that anything had happened. I went to the Casa Fuentes, engaged a room, and immediately afterward went across to the Foreign Club, which I found shut. The town presented a festive appearance, as the flags of all nations were flying from different houses, but there were scarcely any people in the street. The Foreign Club being shut, I went to the Hotel Central, and was lucky enough to find half-a-dozen foreigners whom I knew. Having expressed my surprise at the closing of the club and the deserted appearance of Parral, I was told of some of the happenings since I had last been there a month previous. The Government troops which held the town had been attacked on the 3rd and had repulsed the revolutionists, but the revolutionists came back on the 5th with about 4000 men, attacked and captured the town, and then commenced to loot. Three stores only escaped, namely, the Parral Grocery, Stalforth Hermanos, and Erquicias. The Banco Nacional was not broken-into in any way, as a guard was left there. The Banco Minero was blown-up with dynamite. Several houses were broken-into and robbed, an attempt being made to force a way into the residence of the British Consular

Agent. General Orozco, of the revolutionary forces, apologized next day and said that looting was not to be done; but this is simply a habit of his. He did the same thing after one of his *jefes* had blown open the doors of the Banco Minero vault at Ciudad Juarez and extracted £1700 worth of specie. Orozco claims that the whole of the State of Chihuahua is with him, but this is not so, and I have personal knowledge of several of the residents in the town of Chihuahua, men who have something to lose, not, as are the majority of the revolutionary army, loafers, who never work and never will have any desire to work so long as there is a chance of being out-laws under cover of the revolution. "Why work when we can get more by loafing about with a Mauser." This is the sentiment of half of the so-called insurrectos.

When I wished to leave Chihuahua for Parral about March 10, it was with great difficulty that I got into Orozco's office, only to be told that his royal highness, lately a freighter, could not possibly see anyone. As it was not wise to leave the town without a pass signed by Orozco, especially as I intended to go on horseback to Parral, I said I must see him to get a pass. I was told I could not see him, and it was not till after I had threatened the secretary that I should have to see the British Consul that a pass was forthcoming. In my trip from Chihuahua to Parral only one of the farmers I met was in favour of Orozco, all of the others being in favour of intervention. After arriving at Parral I went out to the mines, situated on the borders of the States of Chihuahua and Durango. All except the outlaws are in favour of the Madero Government. It is possible, not probable, that Orozco will win. If he does, I venture to prophecy another revolution in a few months, and the only thing then to be done will be armed intervention. If, however, something could be done to wake up the United States (more especially the northern and eastern parts), also Great Britain and Germany, so that they would act jointly and form a board of inquiry to hear both sides of the question—that of the Government and that of the revolutionists—something might be done to maintain peace, more especially along the railway lines, which supply the principal mining centres with the necessary supplies.

DONALD F. FOSTER.

London, May 2.

[We refer our readers to an article by Mr. Lane Carter elsewhere in this issue.—EDITOR].

## Costs in Nigeria.

The Editor:

Sir—With reference to your editorial on 'Costs in Nigeria,' appearing in your April issue, please allow me to thank you for your courteous reply to my questions. From the article it is apparent that you have deduced the statement: "The Naraguta has yielded about 12 lb. of concentrate per cu. yd." from the total area worked, and the total cost of tin concentrate produced for the year, but you have overlooked the fact that ground-sluicing is only carried on at Naraguta for approximately six months out of the twelve, and that the remaining six months are devoted to 'calabashing' the river. Half the stated output of the concentrate probably came from calabashing, which at once reduces your average value of the alluvial ground to 6 lb. per yard; and in point of fact, from past records, I think the average value is nearer 5 than 12 pounds.

I do not wish in any way to depreciate the Naraguta mine, which has proved profitable to its past and present owners, and I hope will continue to prove so, but it did not seem fair to other mines or even to Naraguta itself to call it a 12-lb proposition.

As to the second statement for which I asked you to give your figures, namely, "We should regard the wash containing only 3 lb. per cu. yd. as valueless under the conditions existing at present in Northern Nigeria or likely to exist there in the immediate future," I certainly did take it to apply to tin deposits in Northern Nigeria generally, and I am glad to find I am mistaken in supposing that you make so sweeping an assertion. That one particular 3 lb. or 30 lb. proposition is profitable or unprofitable does not interest me so much. May I suggest that it is misleading to write about the yield of the "wash" instead of the yield of the alluvial ground, including wash and overburden. A 12-lb. wash, 6 inches thick, with ½-lb. overburden 20 ft. thick, and therefore averaging 0·8 lb. per cu. yd. is not attractive even in Northern Nigeria, but it may appear so, if you write about "wash" averaging 12 lb. per cubic yard.

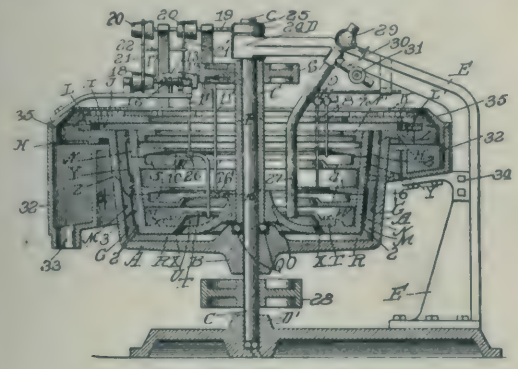
The engineer-in-charge must know the relative value of the wash and overburden in order to decide whether the latter should be sluiced or stripped, but in writing or even reporting on an alluvial area, it is, I think, less confusing and more useful to give the total yield, total cost, and net profit per cubic yard removed.

WILLIAM R. RUMBOLD.

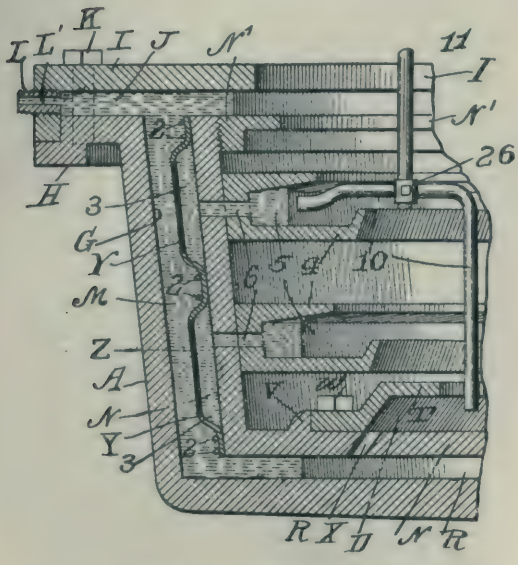
London, April 29.

# PRÉCIS OF TECHNOLOGY

**Peck's Slime Concentrator.**—In our March issue, we described Gee's apparatus for concentrating slime, and herewith we illustrate another machine based on the same idea, invented by Philip F. Peck. This machine is being tried at Anaconda and at Cananea. Our information is extracted from *Metallurgical and Chemical Engineering* for April. No working details or results have ever been published, and our contemporary's article is based on a consideration of the patent specifications. The difference between Gee's and Peck's apparatus lies chiefly in the fact that in the former the revolving surfaces are cylindrical, and in the latter in the form of an inverted frustum of a cone. Also in the former the pulp flows from the top to the bottom, and in the latter in the reverse direction. In the illustrations reproduced here, the slime is fed by the pipe (*27*) and passes through the holes (*X*) into the space between two revolving cones (*A*) and (*N*). These cones revolve independently of each other, being driven by the pulleys (*28*) and (*S*) respectively. While the pulp is being fed, the outer cone revolves faster than the inner one. The heavy particles bed upon the inner surface of the outer cone, and the gangue flows over the top and through apertures (*L*) into a launder. When sufficient mineral has accumulated, the feed is stopped, and a wash of water is delivered to remove middling. Subsequently the speed of the outer cone is reduced to that of the inner cone, and a strong current of water injected to remove the concentrate. The operations are cyclic, and the alterations are effected automatically. Another point has still to be mentioned. In order that the accumulation of concentrate may be done efficiently, it is necessary that the distance between the revolving surfaces should be kept constant, so some method has to be adopted which will preserve the distance as the layer of concentrate grows thicker. The outer surface (*Z*) of the inner cone is for this reason made collapsible, and the liquid pressure behind it is gradually decreased. At the beginning of the cycle, the surface (*Z*) is extended to its maximum and as the layer builds, so the surface (*Z*) automatically collapses. The results obtained by this plant are anxiously awaited.

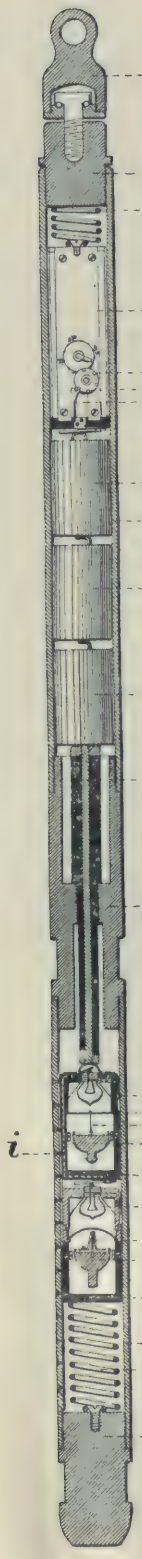


*Peck's Slime Concentrator.*



*Detail of Concentrating Surface.*

**Copper-Nickel Deposits at the Cape.**—The *South African Mining Journal* for March 9 contains an account by A. L. Du Toit, extracted from government reports, of the copper-nickel deposits at Mount Ayliff, in the Insizwa range, East Griqualand. This district is about 100 miles southwest of Pietermaritzburg in Natal, and 50 miles from the east coast of the Cape province. The occurrence of copper ore in this district has been known for twenty years, and a limited amount of prospecting has been done, but without any satisfactory results. The examination of the district by the Cape Geological Survey has given a new impetus, and the account of the geology and ore deposits is of considerable interest. The strata are bluish shales, flagstones, and thin sandstones, belonging to the Beaufort series of the Karroo system, and lying nearly horizontal. These beds have been penetrated by numerous intrusions of igneous rocks in the shape of sheets and dikes. Most of the igneous rocks may be classed as dolerite, but the great sheet of the Insizwa range and of the adjoining peaks and ridges partakes more of the nature of gabbro. The metamorphism of the strata caused by the igneous rocks is more pronounced than in the Karroo and Stormberg districts further west. The copper-nickel ores are found mostly at the contact of the gabbro and the altered sedimentaries. They are also found to a small extent as impregnations of the sedimentaries, but are more abundant in, and sometimes restricted to, the igneous rocks, of which they appear to have been an original constituent. The mode of occurrence is somewhat similar to that of the copper-nickel deposits at Sudbury, Ontario, and in Norway. Owing to the infrequent exposure of the base of the gabbro, the evidence of the presence of ore can only be obtained by sinking, and this has been undertaken when the rocks are stained with carbonate of copper or with silicate of nickel, in the presence of limonite. The three chief minerals found in the lodes are pyrrhotite, chalcopyrite, and pentlandite, that is, a sulphide of nickel and copper of variable composition. The ores can be generally separated into two groups, one consisting chiefly of chalcopyrite, and the other richer in pyrrhotite and pentlandite, but the character of the ore varies so much and the minerals are so finely divided, that it is doubtful whether the minerals preponderating in nickel and copper respectively could be separated mechanically in ordinary ore-dressing practice. Bornite is also found in thin layers along joints in altered sandstone close to the contact. Niccolite, the arsenide of nickel, has been found in thin veins, in the foot wall




*OEHMAN'S APPARATUS FOR SURVEYING BORE-HOLES.*

in one of the workings. Platinum has been detected in varying amounts, and is considered to be in the form of sperrylite, the arsenide of platinum. In one case it has been found in a sample of ilmenite. The assays of a large number of samples have shown the copper to average 4%, the nickel 3·8%, and the platinum 2½ dwt. per ton. The Cape government is affording every facility for further prospecting of this deposit.

**Bore-Hole Surveying.**—At the April meeting of the Institution of Mining and Metallurgy, John I. Hoffmann read a paper on recent practice in diamond-drilling and bore-hole surveying, describing the applications of the Oehman surveying instrument as improved by A. Payne-Gallwey at Vlakfontein and Witpoort in the far east Rand. The principle of the Oehman apparatus is that at a stated time the interior is illuminated by electric lamps and the shadows of a plumb-bob and magnetic needle are recorded on sensitized paper. In the illustration the plumb-bob is shown at (*c*) and the needle at (*b*). Each is mounted over circular sheets of photographic paper attached to the top of gimbals (*d*). The shadows are projected upon the paper by electric lamps (*e*). The upper part of the apparatus contains dry batteries (*k*) and a clock (*j*). The papers are held in position by pin points that penetrate them, and after development the dip and direction can be ascertained by making the pin-pricks coincide. Though this apparatus is nowadays used generally on the Rand, it has never been described before, except when F. H. Hatch read a paper on the subject before the British Association in 1905. As technical men are not likely to have seen this account Mr. Hoffmann's paper is welcome. He also describes an ingenious device for utilizing a bore-hole more than once by fixing deflecting wedges in the hole at any desired depth and thus causing the drill-rods to move off in a different direction.

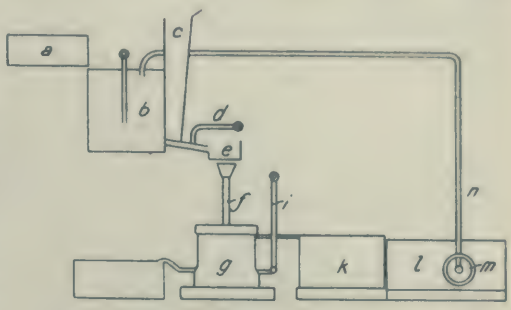
**Gels in Relation to Ore Deposition.**—At the April meeting of the Institution of Mining and Metallurgy E. Hatschek and A. L. Simon read a paper with this title, the object being to explain the presence of gold in the middle of solid quartz, and also the banded form of quartz structure. Thomas Graham in 1861 discovered the difference between aqueous solutions of crystalline and colloidal substances and the fact that the former would diffuse into and out of the latter. Subsequently R. E. Liesegang applied the principle in photographic work with the gelatine gel. He discovered that if a drop of an aqueous solution of silver nitrate was placed upon a film of gelatine containing bichromate of potash, the nitrate would diffuse and react to form bichromate of silver ; and that the reaction would not spread as a uniform halo, but as a series of concentric rings. Bechhold, Ziegler, and Hatschek have continued investigations into this phenomenon by means of test-tubes, the gel containing one of the reacting components being placed in the lower part and the other component in aqueous solution being poured on the top of the gel. Hatschek especially investigated the possibility of reducing gold salts contained in a gel of silicic acid. He half-filled the test tube with silicic acid to which 1 or 2 c.c. of 1% gold chloride solution was added, and allowed the mixture to set. In one set of experiments the reducing agent was then added in the form of aqueous solution such as oxalic acid or ferrous sulphate, and in other sets the tube was introduced into an atmosphere of reducing gas, such as sulphur dioxide, hydrogen, or carbon monoxide. The authors describe the results obtained and show how the gold is precipitated generally in layers in the gel, occasionally being deposited in crystalline form. They found that the best crystals were

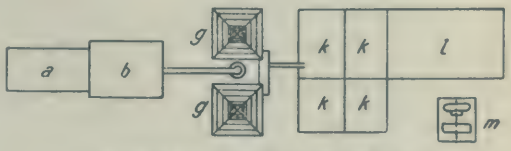
obtained with reagents not readily soluble in water. In some cases a black substance, "probably carbon," is also precipitated. The authors discuss in detail the application of their researches to the formation of gold-bearing quartz veins.

**Lohmannizing.**—*Metallurgical and Chemical Engineering* for April describes a modified galvanizing process invented by H. J. Lohmann. The novelty consists in using a second bath, after the usual acid bath that is required for cleansing the iron or steel sheets. The second bath contains bichloride of mercury dissolved in hydrochloric acid and ammonium chloride. The mercury is supposed to be deposited and to penetrate all the pores. When the sheets are afterward passed through the molten zinc, the mercury is volatilized from the amalgamated surface, and the zinc is able to adhere more closely to the surface thus freshly exposed. By this process it is possible to coat iron and steel with lead, as efficiently as with zinc.

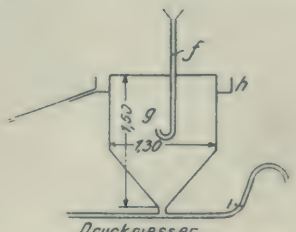
**Leuschner's Flotation Process.** — *Glückauf* for March 9 contains an article describing the Leuschner flotation process adopted at the Friedrichssegen and Ludwigsecke mines in Germany. It is a remarkable article and shows that the inventor, users, and editor of the paper are either unacquainted with the current history of flotation or that someone is taking advantage of the absence in Germany of the more important patents. We therefore accentuate our desire not to be held responsible for any statement contained in the article, by enclosing the abstract in quotation marks.

"Some minerals, especially the sulphides, when in a water bath, possess the property of attaching themselves to gas bubbles or oil drops, and these properties are made use of respectively in the acid and oil processes. The acid process was first successfully applied (1901) by Potter in a warm bath. He did not patent his process in Germany, but a patent in that country was granted to Delprat; this was based on the same idea, but he used sodium sulphate with sulphuric acid, thus obtaining a bath of higher specific gravity and a stronger evolution of gas, less acid being used. The original oil process originated with Elmore, who afterwards added the vacuum. Leuschner started with the idea that a combination of the two processes would increase the useful effect of each, while diminishing the acid and oil consumption, and doing away with the necessity for a vacuum. Oil is added in the ordinary way. As a generator for the gas he used carbonates, present in the ore or added. These ideas showed themselves in practice to be correct assumptions, and herein lies his right to protection by patent. These ideas were first applied in practice at Friedrichssegen for the treatment of a middling product of finest sand and slime, where a Wetherill dry magnetic separator had previously been used but discarded. This sand and slime varied from nothing to 1 mm in size. The ore is a ferruginous blende with quartz as gangue and greywacke as country rock. The installation treats 2 tons of material per hour. The feed assays 10 to 15% of zinc and the tailing 0·3%, and the resultant concentrate contains 47 to 50%. These figures represent an extraction between 90 to 97%. The diagrams illustrate the installation at the Ludwigsecke mine. This was built in the summer of 1911. In this mine galena and blende occur together with spathic iron; quartz is the gangue and greywacke the country rock. Jigs are used to obtain the galena and to separate the waste, and the zinc middling is treated by flotation. In the tank (*b*) a bath is made by the introduction of $H_2SO_4$ from (*a*) into water. This bath is kept at 1° to 2° Be, and 60 to 80° C., the latter by the use of steam jets. In front of the discharge from the tank the material to be treated is delivered through the feeder (*c*). The solution and the material are both delivered on to an inclined chute, together with oil which comes from (*d*). On this chute the mixing takes place, and the pulp then flows into the distributor (*e*) which is made of wood, and lead-lined, through the delivery pipe (*f*) into the separator (*g*). This latter is square, made of wood, and lead-lined. Two separators go to one unit, each being 1500 mm. high, 1300 mm. square at top, and




*Elevation and Plan of Leuschner's Plant.*



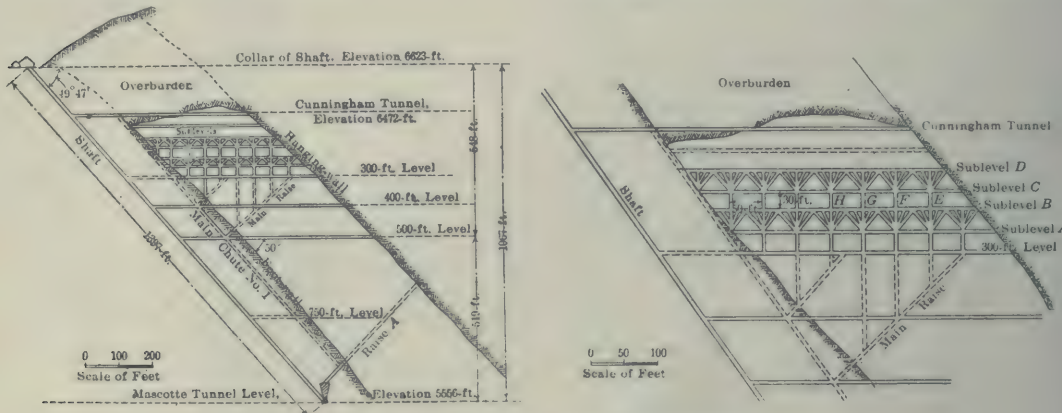

*Detail of Separator.*

with pyramidal bottom. The sulphuric acid acting on the carbonate of iron produces carbonic acid, which carries up the sulphides, these overflowing into the launder (*h*); the tailing descends and is taken away by a water jet. The sulphides go to depositing-boxes (*k*), from which clear water overflows to (*l*), and back again into the circuit through the pump. Acid, oil, and steam are used, and power is required to drive the pump and the washing trommel, 2 to 3 hp. being used per unit. Glover acid 60° Be is used to bring the strength of the bath to 1° to 2° Be. The consumption at Friederikssegen was 40 to 60 kg. of this acid per ton of material treated. Oil residue is used and the consumption varies with the richness of the material treated. With 10 to 15% zinc, it is about 4 to 6 kg. per ton of material treated. This is so small that no attempt is made to recover it, as it does not interfere with the further treatment of the concentrate. As the solution circulates there is little loss of heat. At Friedrichssegen

the cost of maintaining the temperature varies between 0·3 to 0·7 marks per ton of material treated. As to labour, with a single unit 3 men are required, with more than that 2 men per unit. The total operating cost is 4 to 6 marks per ton of material treated, without interest or amortization. The cost of a single unit to treat 10 to 15 tons per 10 hours depends greatly upon the price of lead and is generally from 5000 to 6000 marks."

**Moore Filters and Lactic Acid.** — *Metallurgical and Chemical Engineering* for April gives particulars of the application of lactic acid for the purpose of removing lime compounds from filter leaves. The Moore Filter Co. is now using this acid instead of hydrochloric acid. It is stated that it is equally efficient for the purpose intended, and that it has several advantages. For instance it does not harden and destroy the filter fabric ; also, as it is not volatile or corrosive it can be handled without risk, and can be shipped by rail at ordinary rates. The acid may be regenerated from the calcium lactate by blowing sulphurous acid through the solution.

**Steel Piles in Shaft-Sinking.**—*The Colliery Guardian* for April 12 describes the method adopted at the Hatfield Main Colliery in Yorkshire for sinking a shaft through wet sand. Steel joists were arranged vertically and, as shown in the annexed diagram, their flanges were interlocked by intermediate members. These joists were then driven into the sand by a pile-driver that travelled round the circle. This method of interlocking steel piles is the specialty of the British Steel Piling Co., and is extensively applied in bridge, dock, and railway work. The present instance is its




*CAVING METHODS AT OHIO COPPER MINE.*

**Mining Methods at Ohio Copper Mine.**—The *Engineering and Mining Journal* for April 6 contains an article by C. G. Bamberger on the method of mining by caving adopted at the Ohio copper mine, Bingham, Utah. The orebody is 400 ft. wide, 450 ft. long, 1300 ft. deep, and dips at 50°. It consists of shattered quartzite, containing copper chiefly in the form of finely disseminated chalcopyrite. An inclined shaft was sunk on the foot-wall for the transport of men and supplies, and two chutes, No. 1 and No. 2, were sunk nearer to the orebody, for the delivery of the broken ore to the Mascotte adit level, as shown in the illustration. Main levels were driven across the orebody at 100 ft., 300 ft., 400 ft., 500 ft., 750 ft., and 1006 ft., and by means of cross-cuts and drifts, these levels were cut into blocks 200 ft. square. Between these levels the ground was blocked by sub-levels, cross-cuts, drifts, and rises into blocks measuring 30 by 50 by 25 ft. Details are shown in Fig. 2. Here four sub-levels are shown, (*A*), (*B*), (*C*), and (*D*). Rises were cut vertically from the cross-cuts and drifts on the 300 ft. level through the sub-levels (*A*) and (*B*). From these rises, inclined rises were driven at the points (*E*), (*F*), (*G*), (*H*), etc., in positions similar to the fingers of the hand spread out. At the breast of these several rises, the sub-level (*D*) was removed by blasting, the ore falling through them, into the cross inclined chutes, and thus into the main chute and into the loading station. Similar work was then done on sub-level (*B*), and at the same time on sub-level (*C*), which has been cut up by the finger-like network of rises, comes down with it. The overburden is allowed to come down with the ore, care being taken that the drawing of the ore is stopped when the overburden puts in an appearance. It is noteworthy that by this method there is no shovelling or other handling of the ore, from the time it is blasted to the time when it is delivered into the trucks. The records show that the cost of mining is 28 cents per ton.

first use in connection with shaft-sinking. The preliminary borings showed the following strata at the two shafts :

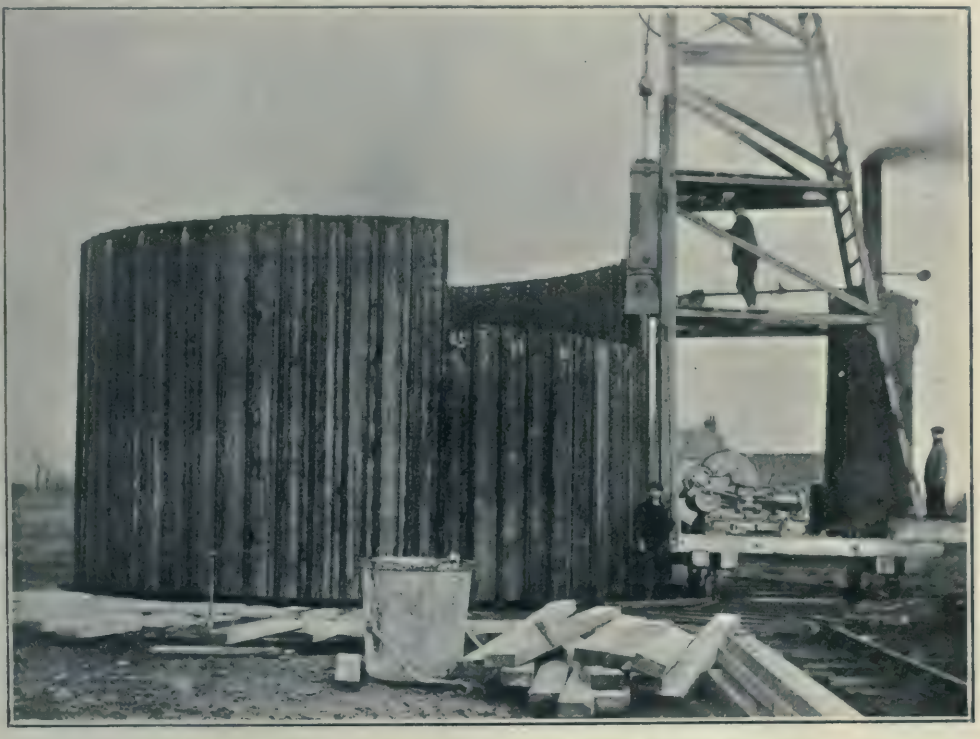
No. 1 Shaft.

| Strata | Ft. | in. | Ft. | in. |
|---|---|---|---|---|
| Soil | 1 | 0 | — | |
| Yellow clay | 1 | 0 | 2 | 0 |
| Blue clay | 2 | 0 | 4 | 0 |
| Soft sandy clay | 7 | 0 | 11 | 0 |
| Fine quicksand | 4 | 7½ | 15 | 7½ |
| Pebble bed | 2 | 2½ | 17 | 10 |
| Fine quicksand | 4 | 2 | 22 | 0 |
| Yellow clay | 0 | 3 | 22 | 3 |
| Soft sandy marl | 0 | 4 | 22 | 7 |
| Quicksand | 4 | 5 | 27 | 0 |
| Yellow clay | 0 | 2 | 27 | 2 |
| Red rock sandstone | 34 | 10 | 62 | 0 |

No. 2 Shaft.

| Strata | Ft. | in. | Ft. | in. |
|---|---|---|---|---|
| Soil | 1 | 3 | — | |
| Yellow clay | 0 | 9½ | 2 | 0½ |
| Blue mottled clay | 9 | 0 | 11 | 0½ |
| Brown quicksand with water | 5 | 1½ | 16 | 2 |
| Pebble bed | 1 | 3½ | 17 | 5½ |
| Sandy clay | 0 | 1½ | 17 | 7 |
| Fine soft red sandstone containing water | 7 | 11 | 25 | 6 |
| Red sandstone | 35 | 6 | 61 | 0 |

The steel joists were 33 ft. long at No. 1 shaft and 28 ft. at No. 2 shaft. They measured 15 by 5 in. in cross section, and the interlocking members measured $6\frac{3}{16}$ by 4 in. The webs were slightly bent so that when assembled the joists could be set up in a circle $26\frac{1}{2}$ ft. in diameter. When driving was commenced, a 30 cwt. weight was used, and each joist was forced down 5 ft., the driving-plant travelling gradually round the circle. Toward the end, 40 cwt. was used, as it was desired to penetrate the sandstone for 3 ft. Each pile was then driven 1 ft. downward at a time, and as many as 1300 blows were required for each foot sunk. When the piles had all been driven, sinking was commenced. It was found that the lining was only $1\frac{1}{2}$ in. out of plumb, and that the leakage was approximately 5 gallons per minute. Experience in other directions has shown that this method of sinking can be successfully employed to a depth of 100 ft. and that within this limit the cost and the time occupied in shaft-sinking should be much less than by any other method.



*STEEL PILES FOR SINKING SHAFT THROUGH WET GROUND.*

*Method of Interlocking Steel Piles.*

**Vertical versus Inclined Shafts.**—A paper by J. M. Nicol discussing the relative advantages and disadvantages of vertical and inclined shafts appears in Vol. II. No. 6 of the *Transactions* of the Mexican Institute of Mining and Metallurgy. In Mexico there is a general prejudice against inclined shafts from the point of view of cost and rapidity of sinking, and also because operations cannot be so easily conducted during development. The author reviews the arguments for and against the two systems, dividing the subject into four parts: (*1*) prospecting and development shafts, (*2*) drainage shafts, (*3*) main hoisting shafts, and (*4*) ventilation or additional egress shafts. The first part is of general interest, and we abstract it herewith. Provided that the topography and dip are such as to make a choice of either method possible, it may be held that the inclined shaft is preferable. The advantages claimed are: (*1*) The vein may be followed however much it changes, and no long cross-cuts are needed; (*2*) when the ore is rich at the outcrop the extraction along the vein will pay expenses; (*3*) as the quartz of the vein is usually softer than the wall-rock, the cost of mining will be lower and the rate of work greater. On the other hand the disadvantages of sinking on the vein are: (*1*) As most veins carry more water than the walls, all the water in a wet zone has to be raised by sinking-pumps during the process of sinking the shaft; (*2*) sinking-pumps do not handle large volumes of water so satisfactorily as station pumps, and they are subject to greater wear from the sharp quartz particles than from the particles of wall-rock; (*3*) if the dip of the vein varies much, there will be many difficulties in maintaining the hoisting work in a smooth and economical manner; (*4*) if the ore

through which the shaft passes is rich, the loss of immediate profit will be serious, for it is clear that the ore cannot be mined without fear of caving until the lower levels are exhausted.

The advantages claimed for the vertical shaft are : (*1*) It reaches the maximum depth in minimum time ; (*2*) it can be sunk more rapidly and timbered more easily ; (*3*) the pumping difficulties are not so great, especially in the matter of suspending the pump, and also in the range of choice of pump ; (*4*) the hauling and hoisting of the ore can be done more economically. In commenting on these arguments, Mr. Nicol considers that as far as pumping is concerned the modern electric sinking-pump is not open to the objections of the steam and Cornish pump in the inclined shaft ; also that as self-dumping skips are now largely used, there is not the same disadvantage with regard to inclined cages for the ore-cars. He also shows that many of the disadvantages of the inclined shaft enumerated above are obviated if the shaft is sunk not on the vein but in the foot-wall. Less water will be encountered than if the shaft is in the vein, and the cross-cuts will be shorter than from a vertical shaft. Also pumping stations and ore bins can be cut in the foot-wall between the shaft and the vein, and there will be no delay in removing any rich ore found in the vicinity of the shaft. The relative value of the vertical and inclined shafts from the point of view of the other three headings, namely, when the shafts are sunk for drainage, or ventilation, or for the economical extraction of known bodies of ore, depends so much on circumstances that no generalization is possible.

**Basic Converters at Copper Cliff.**—At the Toronto meeting of the Canadian Mining Institute held in March, David H. Browne described the new basic converters erected during 1911 at the smelting works of the Canadian Copper Company, at Copper Cliff, Ontario, to treat nickel-copper matte. Previously 10 acid converters had been in use, but as the matte delivered from the blast-furnaces was gradually altered in tenour, becoming lower in copper-nickel and higher in iron, the work became too great for the plant. The furnace mattes treated varied from 20 to 40% copper-nickel, the lower grade containing 2·4 lb. iron per lb. of matte and the higher grade 0·88 lb. iron per lb. of matte. Longer time was required for oxidizing the iron, and larger amounts of acid lining were required ; in addition, the amount of material ejected from the mouth of the converter became troublesome. It was therefore decided to adopt basic converters, that is, converters lined with magnesite, and in April 1911 the first was blown-in. Subsequently the whole of the plant was thus altered, and 5 basic converters now do the work of the old ten. The basic converter is 37 ft. long and 10 ft. diameter, outside measurement. It turns on four tread-rings 12 ft. diameter. The stack or opening in the top for the escape of the gas is in the middle of its length. There are 44 tuyeres, 1¼ in. diam. and 7 in. apart. No tuyeres are arranged directly underneath the stack. The length inside the magnesite lining is 33 ft. 3 in. The bottom lining is 24 in. thick, the back or tuyere wall 18 in. thick, and the front 15 in. thick. The brick around the tuyeres is 24 in. thick. The roof is 12 in. thick. The converter has two openings or spouts in the front wall, opposite to but above the tuyere line. These are used for pouring matte and slag, and the converter is turned into position by means of wire ropes operated by hydraulic power, oil being used as the liquid instead of water. As the plant is electrically driven, safety devices have to be adopted to prevent mishaps in case the current fails.

The initial charge of the converter is about 60 tons of furnace matte, to which is added about 10% of dried quartz-rock. The blast is turned on for from a half to three-quarters of an hour, and the converter is then tilted to pour off the slag. While the slag is being poured 5 or 6 tons of matte is introduced, and after the pouring is completed, 3 tons of quartz or silicious ore is added. Another blow is then commenced, and the cycle of blowing and addition of matte and flux continued until from 70 to 80 tons of finished material has accumulated inside. This generally means the admission of from 300 to 400 tons of furnace-matte, and a period of 30 to 50 hours of blowing time, depending on the grade of the matte.

The basic converter is much larger than the acid plant, a fact simplifying the handling of large quantities of matte. Practically no material is lost by ejectment from the interior. The slag is lower in silica, which means economy of flux. The converter slag contains less copper-nickel than in the acid plant.

**Pulverized Coal for Reverberatories.**—In the paper referred to in the above paragraph, the author also described the new reverberatory furnaces, measuring 112 by 19 ft. hearth-area. The notable feature of these is that they are heated with pulverized coal. Experiments on this line had been made by C. F. Shelby at Cananea and by S. S. Sorensen at the Highland Boy, but though the results showed that this type of fuel could be used, the local conditions were against its adoption. At Copper Cliff, the coal is first broken to ½ in. size, and then ground to 200-mesh in Raymond impact pulverizers. The powder is sucked by a fan into a settler on the top of the building, and when settled is fed by a screw-conveyor to bins at the end of each furnace. From each bin it is taken by five screw conveyers, and fed into a corresponding number of burners, where it drops in front of nozzles. The issuing air-blast blows the coal into the furnace in the form of a cloud, which burns in much the same way as the spray of oil-fuel. Each of the five burners can be worked independently, and the amount of coal and air may be varied at will.

**Aluminium-Zinc-Copper Alloy.**—At the meeting of the Institution of Mechanical Engineers held on April 19, the tenth report of the Alloys Research committee was presented by Walter Rosenhain and S. L. Archbutt, of the National Physical Laboratory. The subject was the alloys of aluminium and zinc. The report is lengthy, and to the average reader, who is not a specialist, the authors' description of a new alloy of aluminium, zinc, and copper was probably the most interesting part. This alloy has given the most important results of all the light ternary alloys so far tried. The composition is 72% aluminium, 25% zinc, and 3% copper. In the cast state it exhibits little or no ductility, but with sand-castings and chill-castings the tensile strength is 18·25 and 20·22 tons per sq. in. respectively. With the usual plant and method employed with aluminium, the hot-rolling of this alloy is difficult, but as the authors have several times obtained perfectly sound bars, they are of opinion that with modifications it should be possible to roll it commercially. Great care is required as regards temperature regulation ; if the alloy is too hot it breaks into powder, and if too cold it becomes excessively hard. The rolled alloy exhibits considerable ductility, but cannot be drawn into wire ; the thinnest section obtained had a diameter of ⅜ in. Remarkable results were obtained in the tensile tests on a ½-in. rolled bar. This showed a yield-stress of 27 tons per sq. in., an ultimate stress of 31·7 tons per sq. in., and an elongation of 21%. By cold-drawing down to ⅜ in. diameter, the yield-

stress is further raised to 31·5 tons per sq. in , and the ultimate stress to 33·3 tons, while the elongation is reduced to 13%. The specific gravity in this condition is 3·29. A compression test gave 24·21 tons per sq. in. as the yield-point, and 29·02 tons as the collapsing-stress. The general conclusion of these and other tests is that this alloy is the strongest per lb. of weight of any yet discovered.

# CURRENT LITERATURE.

**Rapid Tunneling.** — The April *Bulletin* of the American Institute of Mining Engineers contains a paper by David W. Brunton, describing the rapid construction of the Laramie tunnel, driven through Green ridge in northern Colorado, for the purpose of carrying the waters of the Laramie river to a tract of country that is being developed by irrigation. The tunnel is 2½ miles long and has a fall of 500 ft. The delivery of water is 800 cu. ft. per second.

**Hydraulic Mining.**—In the *Mining and Scientific Press* for April 13, C. S. Haley describes a method of treating auriferous gravel, consisting of forcing the gravel up an elevator by means of a monitor. The elevator is made of timbers set apart and the finer gravel falls through to be treated by sluicing.

**Steel 'Timbers.'**—The *Mining and Engineering World* for March 30 reprints a paper by R. B. Woodworth read before the Kentucky Mining Institute on the Economic Aspects of Steel Mine 'Timbers.'

**Gravity Planes.**—In the *Engineering and Mining Journal* for April 13, J. J. Smith describes a new arrangement for gravity planes. By means of a reversible sheave, the loaded cars always go down the same rail and the empties up the other rail. By this method less labour and space are required at top and bottom.

**Mining in Formosa.**—In the *Mining and Scientific Press* for March 23, W. M. Knox reviews the present position of gold mining in Formosa.

**Canadian Coal.**—The *Colliery Guardian's* special issue for April 17 is devoted almost entirely to a description of the coal resources of Canada.

**Michigan Copper.**—The *Mining and Engineering World* commences in the issue of March 16 a series of articles based on Reginald E. Hore's report on the copper mining industry of Michigan written for the Michigan Geological Survey.

**Butte Copper Mines.**—In the *Engineering and Mining Journal* for March 16, W. R. Ingalls estimates that the copper mines of Butte, Montana, will maintain their present rate of output for twenty years, and that the cost will be reduced to 9 cents per pound of copper by the adoption of improved methods of mining and smelting.

**Chino Copper.**—In the *Mining and Scientific Press* for March 30, J. M. Sully describes the concentration plant at the Chino copper mine, New Mexico.

**Heat from Slag.**—The *Iron and Coal Trades Review* for April 19 describes experiments with the Vautin process for utilizing the heat of slag for steam-raising purposes, conducted at Samuelson's blast furnaces, Middlesbrough.

**Greenawalt's Sintering Machine.**—*Metallurgical and Chemical Engineering* for April contains a description of Greenawalt's down-draft sintering pan. This machine was in use at the Modern smelter at Denver from February to June 1910, at which latter date the smelter was closed. The object of the machine was rather to sinter than to desulphurize. Another machine was erected at the Midvale smelter in 1911, but the results were not sufficiently good to warrant a change from the practice then current.

**Drying Gold Precipitate.**—In the *Mining and Scientific Press* for March 16, Donald F. Irvin describes an apparatus for drying the gold precipitate from zinc-boxes by means of electric heat.

**Classifying Middling.**—In the *Mining and Scientific Press* for April 6, Gelasio Caetani discusses practice in connection with the classification of middling products in concentration, and quotes the results obtained with the pipe-classifier at the Tomboy and Bunker Hill & Sullivan mines.

**Zinc-Dust Tests.**—The February issue of the *Journal* of the Chemical, Metallurgical, and Mining Society of South Africa contains a paper by W. J. Sharwood, describing the physical and chemical characteristics of zinc dust, and chemical and mechanical tests for determining them.

**Sampling Copper Bars.**—In the *Engineering and Mining Journal* for April 6, Edward Keller discusses a method of making each separate hole drilled in a copper bar represent the average of the bar.

**Determination of Platinum.**—The April *Bulletin* of the American Institute of Mining Engineers contains a paper by F. P. Dewey, describing a method of determining small amounts of platinum in ores and bullion.

**Domes of Nova Scotia.**—At the Toronto meeting of the Canadian Mining Institute, T. A. Rickard read a paper on the geology of the gold deposits of Nova Scotia. This paper was also presented at the March meeting of the Institution of Mining and Metallurgy.

**Famatina Aerial Ropeway.**—In the *Engineering and Mining Journal* for April 6, C. A. Tupper describes the ropeway built by the Argentine government for the purpose of connecting the Famatina mine with Chilecito.

**Gas Engines at Groenfontein Tin Mine.** — *The Engineer* for March 8 contains a description of gas engines and producers using bituminous coal, in operation at the Groenfontein tin mine in the Transvaal. The engines drive dynamos, and the power is employed for hydraulicking the tin gravel, and in treating it in floating dredges, according to Australian practice.

# BOOKS REVIEWED

DIE METALLURGIE DES WOLFRAMS. By Hans Mennicke. 416 pages, illustrated. Berlin: M. Krayn. Price 17 marks. For sale by *The Mining Magazine*.

This book is a valuable monograph by a specialist. It gives a full account of the occurrence of tungsten ores, the method of mining and treatment, and the metallurgical and chemical processes employed in producing the metal, alloys, and compounds. We hope somebody will translate it into English.

METHODS OF AIR ANALYSIS. By Dr. J. S. Haldane. Cloth, octavo, 130 pages, illustrated. London: Charles Griffin & Co. Price 5s. For sale by *The Mining Magazine*.

Probably the author has given more attention to the question of mine air than any other physiologist in this country. In association with the late Sir C. Le Neve Foster, he issued a book several years ago entitled 'Investigations of Mine Air' which proved acceptable to the coal engineer; but in those days the metal miners were not much interested in improving their atmospheres. The great change that has come over the question during the last two or three years as regards metal mines should secure for this new book a suitable reception. We believe that many engineers have been deterred from studying the subject of analysis of mine gases by the complications of instruments and details. Dr. Haldane has purposely simplified the methods and he goes so far as to describe

various sets of apparatus adapted to the degree of refinement and accuracy required and also of portability. Very likely many gas chemists will raise objections to some of his recommendations on the score of want of exactness and precision, but as the author has worked for many years on this particular application of gas analysis his opinions may be generally accepted by the mine manager. On the other hand, where even minute traces of a gas are apt to work havoc, as is the case with carbon monoxide, his tests are arranged with extreme accuracy.

TEXT-BOOK OF CYANIDE PRACTICE. By H. W. MacFarren. Cloth, octavo, 290 pages, illustrated. New York: McGraw-Hill Book Co. Price 12s. 6d. For sale by *The Mining Magazine*.

The author of this book has established a reputation for clear writing, from the point of view of the practical man, by his work on 'Stamp-Milling and Amalgamation.' The present book is written from a different standpoint, and is intended as a review of all the main processes and principles involved in cyanide operations, for the benefit of students, cyanide workers, and those generally interested. But it purposely stops short of the requirements of the advanced student and the specialist. The cyanide process is a far more complicated one in its applications and ramifications than the ordinary person supposes, and the genus cyanide specialist is divided into many species both as regards the department of the work and the locality of the operations. The difficulty of combining in one work by one man a complete review judicially and eclectically written is exemplified by the form in which 'Rand Metallurgical Practice' and 'Recent Cyanide Practice' have been published. In both cases the books are compilations by numerous contributors who are allowed to give their own experience without much interference or help on the part of the general editor. Mr. MacFarren covers the whole ground, beginning with a history of the process and the nature and properties of cyanide. The process of dissolution, the suitability of ores, the chemistry of the solutions, alkalinity, and ore testing are then discussed. Then follow descriptions of the processes of and plants for percolation, slime agitation, filtration, and precipitation. There are also chapters on cleaning-up, fluxing, and cyanidation of concentrate. Nearly 50 pages at the end are occupied with a classified bibliography which will be helpful to experts as well as to learners.

CAST IRON, IN THE LIGHT OF RECENT RESEARCH. By W. H. Hatfield. Cloth octavo, 250 pages, with many illustrations. London: Charles Griffin & Co. Price 10s. 6d. For sale by *The Mining Magazine*.

A few months ago we reviewed in this column the new edition of Harbord & Hall's 'Steel,' and in earlier issues we have referred to Goerens' and Desch's books on metallography. The present volume by Mr. Hatfield is a worthy companion to these, and it elaborates the modern metallographic theories as applied to one metal alone, namely, cast iron. The author is one of our younger metallurgists, who has already made a reputation in connection with researches in iron and steel, and his book contains a large amount of information based on his own work. He also consolidates and discusses the writings and views of other authorities, presenting in compact form matter that has hitherto only been available by recourse to widely scattered articles, books, and papers. He considers the properties of cast iron from the analytical equilibrium diagram based on the theory of solutions, as applied to the iron carbide system, and his preliminary chapters are devoted to a discussion of this principle. Subsequently he examines by the same method the influence of other constituents such as silicon, phosphorus, sulphur, manganese, vanadium, titanium, nickel, etc. Further chapters deal with the influences incidental to the methods of manufacture, such as the casting temperature, shrinkage and contraction, heat treatment, malleable cast iron, etc. The book is a valuable addition to Griffin's noted metallurgical series.

ELEMENTARY INTERNAL COMBUSTION ENGINES. By J. W. Kershaw. Small octavo, 175 pages, illustrated. London: Longmans, Green & Co. Price 2s. 6d. For sale by *The Mining Magazine*.

The author modestly calls his book elementary, but nevertheless he packs into its small compass a very large amount of practical information concisely expressed. The book is therefore of value to the mining engineer who wants to obtain a general idea of the applicability of gas and oil power, without being overburdened with mathematics and physics. The author commences with the gas engine and gas producers, and subsequently deals with oil engines of the Diesel and other designs, petrol engines, gas turbines, gas pumps, etc. There are three chapters on theory, relating to gas producers, indicator diagrams, and the efficiency of the engines. The economic aspect of this type of engine is treated with clearness. For instance we have read with great interest the author's presentation of the case for and against the oil engine as applied to ships.

THE TIN-MINING INDUSTRY OF NEW SOUTH WALES, By J. E. Carne. Paper boards, octavo, 380 pages. with many maps and illustrations. Sydney: W. A. Gullick. Price 5s. For sale by *The Mining Magazine*.

This book is one of the series of publications on the mineral resources of New South Wales, prepared by the Geological Survey of that State. The author is already known for his work on the copper resources. The present volume contains an enormous amount of detail. It starts with a history of the various discoveries in Australia, then describes the ores of tin, their mode of occurrence throughout the world, and the theories of their origin. The geology of the tin-fields of the State is described, and afterward the work done in each district is treated at length. An interesting chapter is that on tin-dredging, the operations and results of each company being described minutely. The collection of information relating to the occurrence and beneficiation of stannite is welcome. Altogether, the book is a valuable and comprehensive monograph.

OIL AND PETROLEUM MANUAL FOR 1912. By Walter R. Skinner. Cloth, octavo, 200 pages. London: W. R. Skinner. Price 2s. 6d. For sale by *The Mining Magazine*.

THE OIL HANDBOOK. By A. N. Jackman. Pocket size, cloth boards, 320 pages. London: *The Financial Times*. Price 2s. For sale by *The Mining Magazine*.

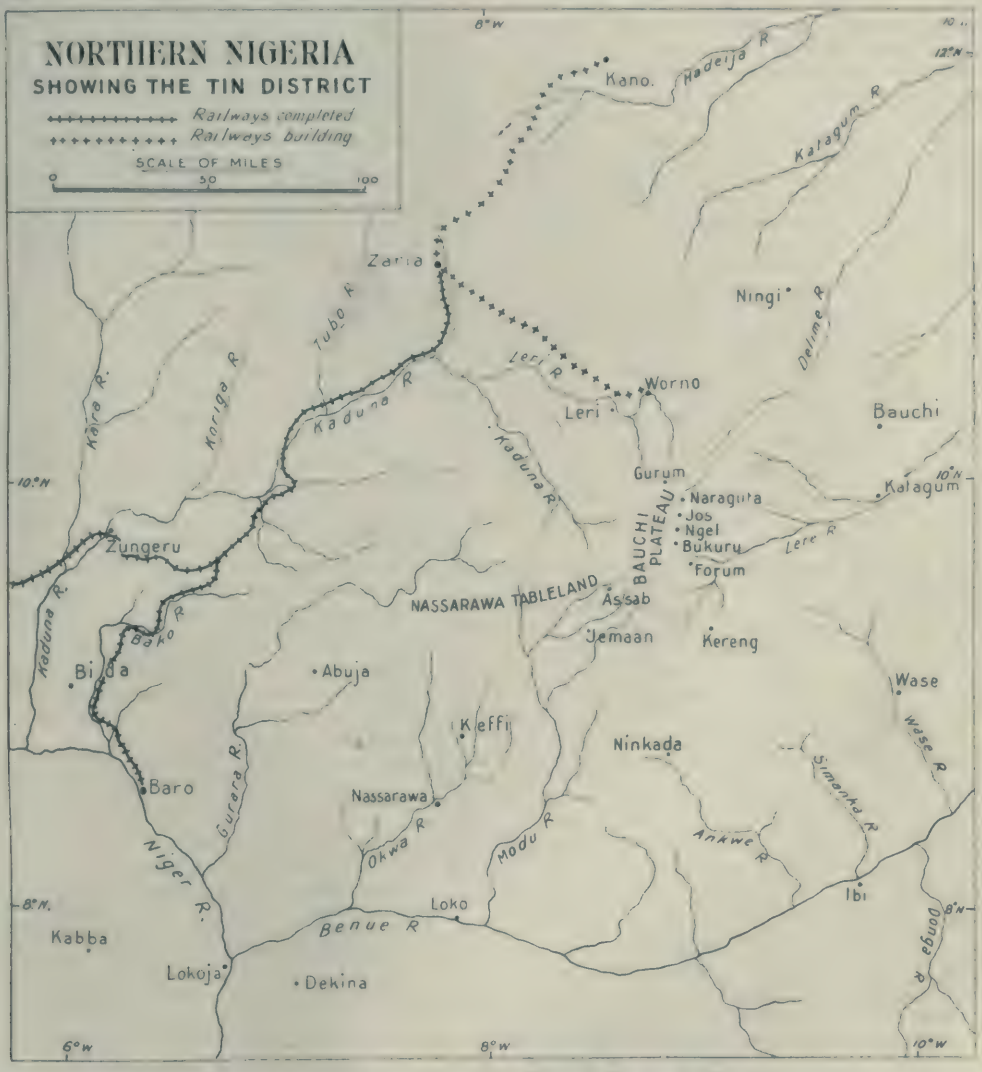
The above two books give particulars of all the companies registered in London dealing with oil properties.

RUBBER-PRODUCING COMPANIES. Compiled by Gow, Wilson, & Stanton, and Gow, Somerville & Co. Cloth, octavo, 600 pages. London: *The Financial Times*. Price 3s. For sale by *The Mining Magazine*.

This book gives full details of all the companies registered in England connected with the rubber-producing industry.

# COMPANY REPORTS

**Bisichi Tin.**—This company was formed in October 1910 to acquire alluvial deposits in Bisichi valley to the southwest of Naraguta. H. W. Laws is consulting engineer and I. C. Penney manager. The property is favourably situated as regards water-supply and fall, and hydraulicking has been adopted for most of the ground. Until the end of last month however the work had been confined to ground-sluicing and calabashing. The report from the foundation of the company to December 31 last shows that 171½ tons of concentrate had been won. Of this, 106 tons has been sold for £138 per ton, the assay being 73·3% metal. The remaining 65 tons in transit when the accounts were prepared has since been received and sold. The cost of production and freight to Liverpool is given as £49 per ton of concentrate. The accounts show £17,315 as the receipts, actual and estimated, from the sale of the 171½ tons after all charges for freight had been paid. The cost of mining was £8846, and London expenditure accounted for £2768. The net profit was £6490, which was carried forward. Since the beginning of the year, the production at the mine has been 60 tons, which is lower than the average. The reason is that the labour force is scarce and men have been taken from the ground-sluicing operations to help in the erection of the hydraulic plant. This plant has now started work and it is expected thereby to increase the output to 60 tons per month. The company has acquired interests in the Lafon and Zuma companies operating in the same district. We refer to this report in our editorial columns.




**Mount Bischoff Tin.**—The report of the premier tin mine of Tasmania for the half-year ended December 31 shows that 120,768 tons of ore was mined, and, after sorting, 103,412 tons was sent to the mill. These figures are much the same as during the previous two half-years as reported in our pages. The yield was 550 tons of concentrate, being an extraction of 10·2 lb. per ton. The working cost at the mine increased from 4s. 2d. to 4s. 4d., owing to falls of overburden caused by the severe weather. The additional 10 stamps and accessory plant have now been erected, after lengthy

delays caused by the scarcity of labour; and the directors state that if the development work on the other side of the hill continues to be satisfactory, a further extension of the plant will be undertaken. At the smelting works at Launceston, 2047 tons was smelted, of which 565 tons was the company's ore, yielding 378 tons of tin. The remainder was custom ore amounting to 1482 tons, and yielded 1038 tons of tin. The average assay of the metal produced was 99·88%. The accounts showed a profit of £40,019, out of which £30,000 was paid as dividend, as compared with £22,500 during the previous half-year, £6848 was written off for depreciation, and £2520 paid as tax. During the previous half-year the dividend was smaller on account of disbursements in connection with the new plant.

**Sons of Gwalia.**—This gold mine is situated at Mt. Leonora, in the North Coolgardie district of Western Australia. The company was floated in 1898 by Bewick, Moreing & Co., who are still the general managers. The years 1903–4–5 were the most profitable. The report now issued covers the year 1911, and shows that 165,664 tons of ore was raised, and that the production of gold was 70,642 oz., of which 45,143 oz. was obtained by amalgamation, 10,805 oz. by cyaniding sand, 7220 oz. by cyaniding slime, 6931 oz. in concentrate, and the remainder from slag and accumulated slime. The income from the sale of gold was £300,157, and after taxes, administration, depreciation, and percentages of profit paid to directors were provided for, £81,250 was distributed among shareholders, the rate being 25%. A large amount of development work was done, and though the content of the newly found ore was not so high as that treated during the year, the total tonnage was increased from 3½ years supply on December 31, 1910, to 3 years 8 months supply on December 31, 1911.

**Great Boulder Perseverance.**—This mine at Kalgoorlie has had more than its share of ill-luck. The collapse of 1904 provided one of the sensations of the day, and the destruction of the surface plant by fire in 1909 is still fresh in our memories. The report now issued contains the unwelcome announcement that, though a profit of £48,458 was made for 1911, it is inadvisable to declare a dividend, owing to the fall in the content of the ore extracted toward the close of the year. During 1911, 243,109 tons of ore was raised and treated, yielding 72,415 oz. gold worth £308,570. The cost charged to revenue is given as £219,690 or 18s. 1d. per ton, but this does not include development £25,246, depreciation £7023, and other items which bring the cost to £262,076 or 21s. 7d. per ton, or 3s 6d. per ton more than the figure given in the report. The ore reserve on December 31 last was 807,664 tons averaging 5·63 dwt. or 23s. 11d., as compared with 772,214 tons averaging 5·74 dwt. or 24s. 3d. the year before. Hooper, Speak & Co. are the general managers and consulting engineers, and R. A. Varden is manager at the mine.

**Ivanhoe.**—This gold mine at Kalgoorlie, Western Australia, commenced producing in 1898, and the first dividend was paid in 1899. The production and profits have been maintained without a break up to the present time The developments during 1911 have been generally satisfactory, and the ore reserve was increased by 103,385 tons, the figure on December 31 standing at 1,088,421 tons averaging 43s. 7d. The deepest level is at 2570 ft., but neither here nor at the 2420 ft. level has any ore of high or average grade yet been found. The general appearance of the orebodies is that a depth has been reached where the content is likely to be substantially lower. Bewick, Moreing & Co. are the consulting engineers, and R. B. Nicolson manager. The report for 1911 shows that 238,965 tons was raised and sent to the 100-stamp mill. By amalgamation gold worth £140,272 was recovered; by cyaniding sand £68,680; by cyaniding slime £165,478; and by roasting and cyaniding concentrate £108,353; making a total yield of £482,783 or 40s. 4d. per ton milled, an extraction of 88·6%. Two tube-mills were added for the purpose of re-grinding the coarse sand overflowing from the pans used in grinding the sandy tailing from the stamp-mill, and extra tables were added to deal with the increased amount of mineral thus liberated. The working cost was £252,414 or 21s. 1d. per ton milled. After taxes and cost of administration were paid, the profit was £218,221, and £220,000 was distributed as dividend. The total dividends paid to date have been £2,910,000, while £890,338 has been written off the plant, buildings, and development account. The property is still valued in the balance-sheet at £945,704. The company holds investments valued at £163,692, of which about £100,000 is in gilt-edged securities, and the remainder in various mining ventures. Since this report was published, the directors have announced that the profits during 1912 will be less by £24,000 owing to the lower average grade of the ore now being stoped.

**British Broken Hill.**—This mine has been prominently before the notice of the public during the last six months, owing to the discovery of a new lode that promises to bring prosperity to a company that has not been over-successful in the past. The report now issued covers the half-year ended December 31 last. During this period, 81,076 tons of sulphide ore and 701 tons of carbonate ore were mined. The lead concentration plant treated 81,001 tons, averaging 14·4% lead, 12·7% zinc, and 7·8 oz. silver, and the production was 13,008 tons of concentrate, averaging 63·6% lead, 7·2% zinc, and 26 oz. silver. The company's Elmore plant treated 41,740 tons of zinc tailing, averaging 15% zinc, 3·7% lead, and 3·7 oz. silver, and produced 11,801 tons of zinc concentrate, averaging 41·8% zinc, 10% lead, and 10·6 oz. silver. After allowing for depreciation and debenture redemption, the profit was £61,910, out of which £45,000 was paid as dividend. No information is given relating to the new orebody, further than already published from the reports of W. H. Woodhead and G. C. Klug.

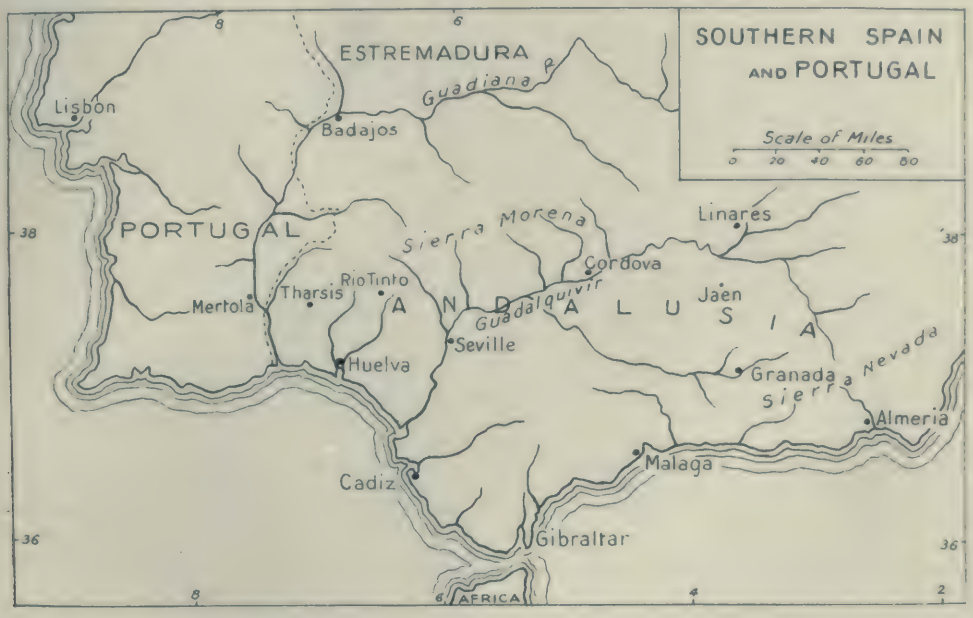
**Amalgamated Zinc (De Bavay's).**—This company was formed in Melbourne at the end of 1909 to acquire and extend the flotation process invented by A. J. de Bavay. The control is with the Baillieu group, and the business consists of treating the zinc tailing from the North and South mines at Broken Hill belonging to the same group. The company also secured the contract for the treatment of zinc tailing from the Block 10 mine, but this mine is not at present producing owing to the reorganization of the lead concentration plant. The report now issued covers the half year ended December 31 last. During this time, 256,454 tons of zinc tailing was treated, and the production was 75,587 tons of zinc concentrate, assaying 48 7% zinc, 6·6% lead, and 9·7 oz. silver, and 1408 tons of lead concentrate assaying 53·8% lead, 16·8% zinc, and 32·2 oz. silver. The income was £264,728, part of which came from the sale of current zinc concentrate, the price of zinc being figured at £22 per ton, and the remainder from the adjustment of the account of the previous period, taking £26. 11s. 7d. as the settlement price for zinc instead of £22. The balance of profit for the half-year was £122,291; out of this, £20,000 has been placed to the equalization reserve fund, £10,000 placed to reserve for depreciation, and £50,000 distributed as dividend. Since the end of the period

under review a further £50,000 has been paid to shareholders. As with the previous period, there will be a further income for the past six months on the final adjustment of prices. For every £1 above £22, the company will receive £13,600 additional on the 75,587 tons sold.

**Waihi.**—A year ago this famous New Zealand gold mine began to exhibit for the first time the signs of impoverishment in the lower levels. The report for the year 1911 now published shows that 350,699 tons of ore was treated yielding gold and silver worth £679,116. A year ago the figures were 442,020 tons and £926,099. The ore averaged 8⅝ dwt. gold and 3½ oz. silver per ton, having a total assay-value of 42s 10d., or 3s. 9d. less than in 1910, and 10s. 2d. less than in 1909. The extraction was 91½% of the gold and 76% of the silver. About 80% of the yield comes from the amalgamating plates and from the sand and slime cyanide-treatment plant, while 16% is won from concentrate, and the remainder from various residual products, The expenditure in New Zealand and London, including development, was £321,293, and the profit was £371,539. Out of this £38.682 has been paid as taxes, and £272,748 distributed as dividend, being at the rate of 55%, as compared with 80% in 1910 and 90% in 1909. It was the 9th level, especially on the Martha lode, that provided the disappointment a year ago. Unfortunately the 10th level is doing no better. The directors and managers still hope that it is only a zone of impoverishment that is causing the trouble, and that richer ground will once more be found below. Development is therefore being vigorously pushed. The ore reserve on December 31 was estimated at 828,012 tons together with 706,814 tons left in pillars and arches. During the year the Union mill of 40 stamps and 1 tube-mill was sold to a neighbouring mine. The Hora-Hora hydro-electric power installation is being constructed as rapidly as possible. The reports of the directors, engineers, and metallurgists, are as usual full of detail, but the directors and the technical staff differ as regards the nature of the ton employed, there being a confusion between short and metric tons.

**Mason & Barry.**—This company was formed in 1878 to acquire the San Domingos pyrite mine at Mertola, Portugal, which had been worked by the firm of Mason & Barry since 1858. It was reconstructed in 1892, and since then the capital has been gradually reduced until it now stands at £185,172 in £1 shares. In early days the mine was a large producer of copper, but latterly the pyrite is valuable almost entirely for its sulphur content. The report for 1911 shows that 412,023 tons of ore was raised, as compared with 360,406 tons in 1910, and that the shipments of ore, raw and washed, was 277,583 tons, as compared with 294,443 tons. The profit at the mine was £59,892, and £55,551 has been distributed as dividend, being at the rate of 30%, the same as last year.

**Tharsis Sulphur & Copper.**—This company has its headquarters at Glasgow, and owns the Tharsis and Calanas mines in the south of Spain. It was formed in 1866 and has paid dividends continuously since 1868. The total distribution has been £9,508,432, or 848%, and in addition £2,498,777 has been written off the property and plant account. The mines now stand in the books at £20,000, and the plant, etc., at £106,824, while the assets in cash and securities amount to £1,106,183. The report for the year 1911 shows that 50,741 tons was mined at the Tharsis mine, and 282,027 tons at Calanas, a total of 327,348 tons, as compared with 362,750 tons in 1910. The shipments, including washed ore, were 481,700 tons. The copper precipitate produced on the spot and shipped during the year was 2249 tons. At the works in Great Britain the production of refined copper was 3393 tons. This includes the copper in the precipitate. The company also handles the purple oxide of iron returned from the alkali works. During 1911 the sale of this was less than in 1910, but the price obtained was higher. The profit for the year was £188,139, out of which £187,500 was distributed as dividend, being at the rate of 15%. This compares with 12½% paid during the three previous years. For a long time the company has been endeavouring to obtain another property, but none has yet been found that is suitable.



**San Francisco del Oro.**—This company was formed in 1903 to acquire a mine at Parral, Chihuahua, Mexico, containing argentiferous sulphides of lead and zinc. At first, the best ore was shipped to smelters, but in 1908 it was decided to erect concentrating plant that would make it possible to beneficiate a much larger proportion of the ore. The plan was to sell the lead concentrate locally, and to ship the zinc middling to electric smelters in Sweden. We gave full details in our issue of April 1910. The company was reconstructed in 1908 in order to provide the necessary additional capital. The report for 1911 now published shows that operations have been hindered by the Mexican revolution, by the delay in completing the aerial tramway from the mine to the mill, and by the faulty design of the new plant, especially the furnaces for roasting the zinc middling. During the four months September to December, it was possible to concentrate some low-grade dump material. The aerial tramway has been completed since the end of the year. An interim arrangement has been made with the Cape Copper company for the roasting of the zinc middling at Britonferry, South Wales, but there is a prospect of the middling being sold in its raw state to the Swedish smelters in the course of a few months. Percy Tarbutt & Co. have resigned as consulting engineers, and Knox & Allen of New York have been appointed to succeed them. Until H. H. Knox's report on the mine is received, any proposition as to the modification of future policy is postponed.

**Globe & Phœnix.**—In writing of this premier gold producer of Rhodesia a year ago, we recorded that during 1910 operations were greatly hindered owing to the necessity of re-timbering the main shaft. The report for 1911 now published shows that though the mine was in full working order the scarcity of labour made it impossible to run the mill more than 315 days; moreover the reorganization of the sand-treatment plant has been greatly delayed. During the year 1911 71,802 tons was sent to the mill, where 100,006 oz. of gold was recovered by amalgamation. In addition, 14,569 oz. was recovered from sand, slime, and concentrate, making the total yield 114,575 oz., worth £484,600. The cost at the mine was £120,418, and £20,483 was allowed for depreciation. After administration and taxes had been provided for, the available balance was £321,293. Out of this, £320,000 has been distributed as dividend, being at the rate of 160%. As regards the ore reserve, this has been well maintained, standing at 173,613 tons averaging 37 dwt. per ton. The developments at the 17th and 18th levels are not altogether satisfactory, as there is much disturbed ground and the ore is of lower grade; but H. A. Piper, the consulting engineer, is not yet prepared to interpret the indications. The main shaft is down 2672 ft. on the dip, and Mr. Piper recommends the sinking of a new vertical shaft. As regards the new sand-plant, this is expected to be at work by August.

**Bucks Reef.**—The report for 1912 of this company owning gold mines in the Gwanda district of Rhodesia shows that the results are much below expectations. The present company was formed in May 1909 by the Neumann group, and in May 1910 a new mill consisting of 5 stamps weighing 2000 lb. each was built. The properties consist of the Bucks mine, Prestwood mine, and the Beaufort claims. During the year 1911, 5582 tons was raised from the Bucks, 4012 tons from the Prestwood, and 339 tons from the Beaufort. The total treated at the mill was 9933 tons, and by amalgamation and cyanide 7366 oz. was recovered. The gold realized £30,287. The working cost was £23,707, and the cost of administration £2382, leaving a profit of £4597. In addition, £6928 has been spent on capital account on development and plant. The reports of J. E. McGuire, the resident engineer, and James Black, the manager, show that the development work has been unsatisfactory. All work has been stopped at the Beaufort. Unless the results at Prestwood and Bucks West do not improve, it will be impossible to keep the mill fully supplied during 1912. On December 31 the ore reserves were 3373 tons averaging 13·9 dwt. at the Bucks, and 1873 tons averaging 11·8 dwt. at the Prestwood.

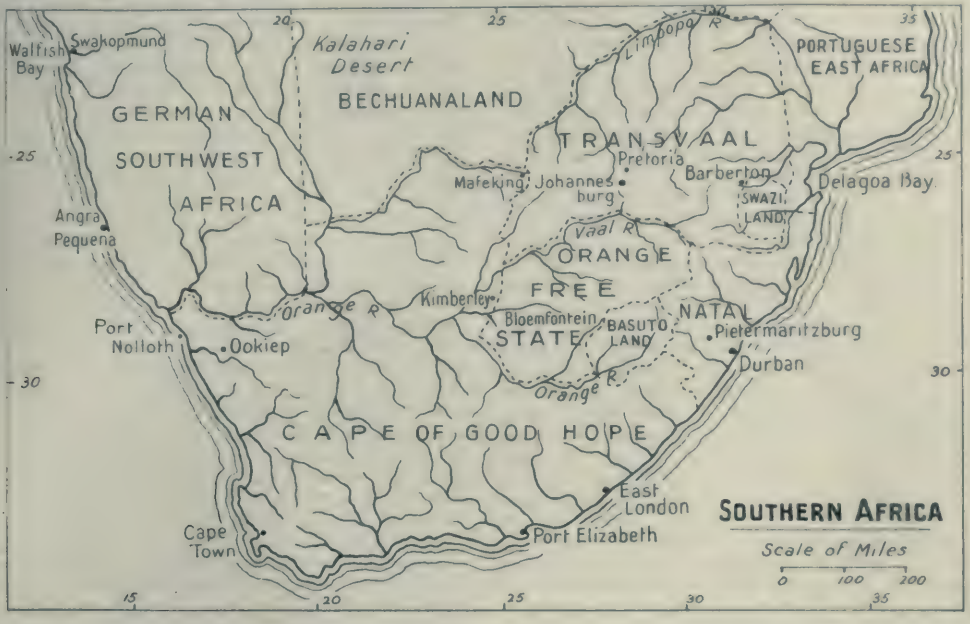
**Ooregum.**—This member of the Kolar group of gold mines in India, managed by John Taylor & Sons, has not been so uniformly successful as its neighbours, the Mysore and Nundydroog, and at the present time the position and outlook are not particularly favourable, though the output and profit have been well maintained. During the year 1911 the amount of ore treated was 152,545 tons, which yielded 84,525 oz. gold worth £357,919. For 1910 the figures were 149,416 tons, 84,151 oz., and £357,119. The profit was £157,209, out of which £8347 was paid as income tax, £10,000 allowed for depreciation, £15,000 placed to reserve fund, and £120,231 distributed as dividend, as compared with £129,250 for 1910. The preference dividend was at the rate of 40% and the ordinary 30%, as against 42½% and 32½%. The reduced profit was due to the increase of £12,123 in expenses, owing chiefly to extra repairs to plant and buildings. In addition £20,080 has been spent on capital account on buildings and plant. A vacuum-filter plant has been erected for the treatment of slime, having a capacity of 60 tons per day. Additional territory has been acquired on the dip of the lode. The ore reserve stood at 186,576 tons on December 31, being an increase of 2298 tons during the year. R. H. P. Bullen, the superintendent, reports that the most recent developments are less favourable, and that in consequence he cannot forecast the current year's yield. During the year exploration and development work has been done on the Manighatta property, 16 miles north of the Kolar group, on the site of ancient workings, but it is impossible as yet to form any opinion as to its value.

**Namaqua Copper.**—This company owns mines at Concordia, Little Namaqualand, on the west side of Cape Colony, and situated not far from those of the Cape Copper Co. at Ookiep. Operations commenced in 1887 and the results have generally been good. In 1908 and 1909 no profit was made, owing chiefly to the low price of copper. During 1910 and 1911 the ore has been selected, and only one of the two furnaces kept in blast; consequently profits were made once more. The report for 1911 shows that 43,548 tons of ore was raised, and after the rejection of 2944 tons as waste, and the removal of 5098 tons of low-grade ore for future treatment, the remainder was sent to the blast-furnace. The production was 4183 tons of matte, containing 2385 tons of copper. The tonnage was higher than in 1910, but as the grade was lower the produce was 89 tons of copper less. The matte was sent to the works of the Cape Copper Co. at Britonferry, South Wales, for treatment. The profit on the year's work was £53,319, out of which £7550 was placed to the account for new plant, and £47,165 distributed as dividend, being at the rate of 25% as compared with 12½% in 1910. The item relating to new plant refers to the provision of a new central power-plant consisting of electric generators driven by Diesel oil engines. This plant started work on January 1, 1912. During the year leaching of low-grade ore was commenced, and 32½ tons of precipitate containing 25½

tons of copper was produced. Developments at the Tweefontein mine have given fair results, but though the tonnage of ore reserve has been increased by 9694 tons during the year, the content has slightly decreased. The figures on December 31 last were 104,677 tons averaging 6⅜% copper. The efficiency of the smelting furnace has been increased, both as regards capacity and reduction of the percentage of coke used.

**East Rand Proprietary.**—The general position at this mine is sufficiently well known to require any recapitulation here. The report for 1911 now issued shows that during the year 2,354,336 tons of ore was raised, and after the removal of 7% waste, 2,194,552 tons was sent to the batteries. There are in all 820 stamps and 25 tube-mills. The screen-assay of the feed was 6·579 dwt. By amalgamation 366,787 oz. of gold was recovered, and by cyaniding 297,517 oz., a total of 664,304 oz. or 6·054 dwt. per ton. The revenue was £2,784,882, or 25s. 4d. per ton milled, a decrease of 1s. 11d. as compared with 1910. The working cost was £1,828,261 or 16s. 8d. per ton milled, an increase of 1s. 3d. per ton as compared with 1910. The working profit was £956,621 or 8s. 8d. per ton as compared with 11s. 9d. in 1910. Out of the profit £67,878 went as debenture interest, £11,195 as extra miscellaneous expenditure for various purposes, £86,625 as profits tax, and £57,828 was placed to expenditure on capital account. The dividends absorbed £733,769 or 30%, as against the 40% predicted. The ore reserve was calculated on December 31 at 6,716,605 tons averaging 6·9 dwt.; the unprofitable ore is given as 11,150,397 tons averaging 2·6 dwt. The reduction in the figures for profitable ore as compared with those a year ago is partly due to the fact that the minimum has been raised from 3·1 dwt. to 4·3 dwt. We would mention also that the cost per ton is due to recent alterations in the basis of calculation, and to the revision of the classification of development work. The report by H. Ross Skinner, the superintending engineer, also shows that many specious devices intended for the attainment of low working cost have been swept away. It has not been possible to keep development work at a level with the capacity of the mills owing to there not being sufficient development faces, especially at the Angelo and Driefontein sections. It will therefore be necessary to do more sinking of secondary inclines and development shafts. Mr. Skinner outlines a scheme for continuing the development in the deeper portions, namely, the Angelo Deep and the Hercules.

**Crown Mines.**—This company was formed in July 1909 to amalgamate the Crown Deep, Crown Reef, Langlaagte Deep, Robinson Central Deep, Langlaagte Royal, and Paarl Central, all belonging to the Rand Mines group. During the year 1911, the ore raised totalled 1,831,182 tons, and after the removal of 11·7% waste, 1,618,500 tons went to the stamps, averaging 8·68 dwt. The yield by amalgamation was 481,612 oz. and by cyanide 193,216 oz., a total of 674,828 oz. or 8·34 dwt. per ton milled. The income was £2,831,625 or 35s. per ton milled, the working cost £1,560,518 or 19s. 4d. per ton, and the working profit £1,271,106 or 15s. 8d. per ton. On capital account £685,894 has been spent on development, a new 160-stamp mill, and other plant. The sum of £1,034,110 was distributed as dividend, being at the rate of 110%, as compared with 120% a year ago. On December 31 the ore reserve was calculated at 10,124,072 tons averaging 7¼ dwt., as compared with 6,282,719 tons averaging 7·6 dwt. a year ago.




**Ferreira.**—This mine, situated in the central Rand between the Robinson and the Village Main Reef, is how nearing its end, and, as under the present circumstances the working conditions are becoming unfavourable, it has been decided to amalgamate with Ferreira Deep, and to leave the remainder of the work to the latter company. As both companies belong to the Rand Mines group, the reorganization is of no outside importance. During the year 1911, the ore mined was 340,433 tons, and after the rejection of 9% waste, 310,300 tons was sent to the mill. The recovery was 66,833 oz. by amalgamation and 36,376 oz. by cyanide, making a total of 103,209 oz. worth £432,727, being 6·65 dwt. or 27s. 11d. per ton milled. During the year 1910, the ore milled was 346,150 tons, the yield

134,214 oz., value £564,376, and yield per ton milled 7¾ dwt. or 32s. 7d. The cost during 1911 was £257,404 or 16s. 7d. per ton, leaving a profit of £175,322 or 11s. 4d. per ton. For 1910 the cost per ton was 15s. 9d. and the profit 16s. 10d. The dividend declared absorbed £190,000, and there is still an undivided balance of £166,058. The reserve of ore left in the mine on December 31 was 324,603 tons averaging 8·13 dwt.; of this, 146,645 tons was in blocked ground and the remainder in pillars. There is also some ore, left as packing in narrow stopes, that can now be extracted.

**Robinson.**—This mine on the outcrop in the central part of the Rand has been producing since 1888 and paying dividends since 1889. Though bearing the name of the controller of the Langlaagte and Randfontein properties, the mine has for the last twenty-one years belonged to the Wernher-Beit-Eckstein group. Percy Cazalet is now consulting engineer and Paul Selby manager. During the year 1911, the ore mined was 710,000 tons, and after the removal of 16% waste, 592,700 tons went to the mill, averaging 11·2 dwt. per ton. The recovery was 226,736 oz. by amalgamation and 93,856 oz. by cyanide, a total of 320,592 oz. worth £1,344,820, being 10 82 dwt. or 45s. 5d. per ton milled. The working cost was £433,512 or 14s. 8d. per ton, leaving a profit of £911,308 or 30s. 9d. per ton. Out of the profit, £46,153 was spent on new plant, especially in connection with the installation of Butters filters, £58,220 on the acquirement of mining rights under government ground, and £84,410 disbursed as profits tax. The shareholders received £756,250, being at the rate of 27½%, as against 30% paid during the previous three years. As compared with last year the ore milled was 46,000 tons less and the yield 4800 oz. more, thus bringing the yield per ton 1 dwt. higher. On the other hand the expenses increased by 2s. 6d. per ton. This increase is due partly to the scarcity of labour and partly to the extra cost of supporting the exhausted workings. The reserve on December 31 was estimated at 1,221,661 tons in the Main Reef Leader and the South Reef averaging 11·4 dwt., and 1,307,133 tons, averaging 4·2 dwt., in the Main Reef. The conditions in the Main Reef during the year have been unfavourable, and the reserve has had to be reduced by 895,304 tons, owing to the content of many large blocks proving to be of lower grade than estimated. During the last year or two the low cost at this mine had encouraged the mining of the Main Reef, and the failure of the ore to maintain its reputation is a great discouragement. The manager also reports serious losses in the Main Reef owing to caving, which is likely to continue. The reason the content of the ore milled increased during 1911 was that a smaller proportion of the Main Reef ore was raised. The additional ground acquired from the government has been actively developed during the year. The Butters filter plant has proved a success, as only 0·2 dwt. per ton is now left in the residue.

**Benoni Consolidated.**—This company was formed in 1895 to acquire property in the far east Rand, but it is only recently that active development was started. The control is with the Anglo-French Exploration, and Edward J. Way is consulting engineer. A mill containing 55 heavy stamps and 4 tube-mills commenced operations in November last. The report for 1911 now issued covers too short a period of milling to provide any indication of what can be done; suffice it to say that the Arbuckle-Way plant for treating the slime has not yet given a profitable performance. On December 31, the reserve was estimated at 522,671 tons averaging 6·8 dwt. Later information is given in our 'Review of Mining.'

**City Deep.**—This company was formed in 1899, and in 1908 additional adjoining properties were absorbed, so that the area now owned consists of the deep levels of the City & Suburban, Meyer & Charlton, Wolhuter, and New Goch. A mill containing 200 heavy stamps and 9 tube-mills started work in December 1910. The control is with the Rand Mines, H. Stuart Martin is consulting engineer, and M. O. Tillard manager. The report for 1911 shows that the mine is not yet delivering ore to the capacity of the reduction plant, owing to the labour difficulty. The force has been recruited largely from Central African natives, and these have proved inefficient, for climatic reasons to which attention has already been drawn in our pages. Inadequate ventilation has also prevented good work. Conditions have been remedied slightly by the provision of an underground fan, but further steps are necessary, and to this end cross-cuts are being driven to the main downcast shaft. During the year, 285,960 tons was raised from the mine, and this together with 109,716 tons from the dump was sent to the sorting station, where 11·6% waste was removed, and 349,913 tons delivered to the mill. Only 90 stamps were running, for 295 days. The estimated content of the ore milled was 7·63 dwt. The yield by amalgamation was 90,820 oz., and by cyanide 37,293, a total of 128,113 oz. The assay-value of the tailing was 0·347 dwt. The revenue was £537,548, or 30s. 9d. per ton, and the working cost £406,634, or 23s. 3d. per ton, leaving a profit of £130,914, or 7s 6d. per ton. Out of the profit, £40,735 was written off development account, so the balance left was £90,935. At the beginning of the year the company had £61,814 in hand of unexpended capital. The capital expenditure during the year was £117,581, and the remainder, £55,767, was provided out of the year's profit. The ore reserve on December 31 was estimated at 2,078,805 tons averaging 8·1 dwt.

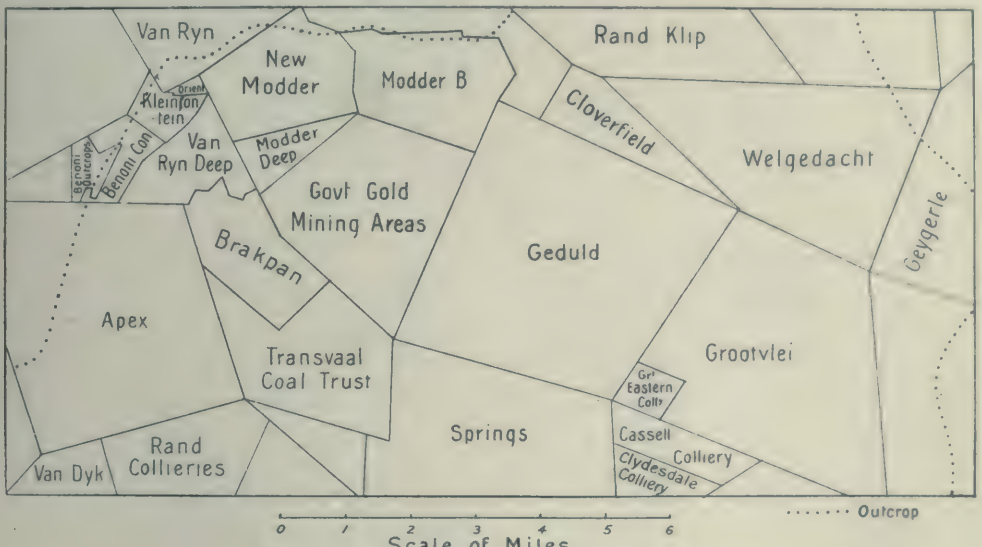
**New Rietfontein.**—This company was formed in 1892 to acquire an isolated property eight miles north of Johannesburg, and the geological relation of the lode to the Main Reef series of the Rand is still one of the unsolved problems. The control is with the Barnato group, J. G. Lawn is consulting engineer, and J. L. Bull is manager. The present equipment consists of 120 stamps and 3 tube-mills. During the year 1911, 230,193 tons of ore was raised and, after the rejection of 21½% waste, 180,822 tons averaging 6·5 dwt. was sent to the mill. By amalgamation and cyanide, 54,953 oz. of gold was extracted, being at the rate of 6 dwt. per ton. The revenue from the sale of gold was £233,647, or 25s. 10d. per ton. The working cost was £194,297, or 21s. 6d. per ton, leaving a profit of £39,349, or 4s. 4d. per ton. The sum of £30,504 was distributed as dividend, being at the rate of 5%. The ore reserve stood at 361,484 tons averaging 6·1 dwt.

**Rose Deep.**—This company was formed in 1894 and milling started in 1897. In 1909 an amalgamation was effected with the adjoining Glen Deep, and the two mines are now working under one organization. The combined mill contains 300 stamps and 7 tube-mills. The control is with the Rand Mines. The property is isolated from the rest of the group, and is on the dip of the Primrose, May, and Glencairn. During 1910 serious caving in the upper levels occurred, and the winding-shaft was in a dangerous condition. Since then the mine has suffered from labour shortage, and it was not until the second half of 1911 that the mills were kept fully supplied. The report for 1911 shows that 821,555 tons was raised and, after the removal of 15½% waste, 693,250 tons averaging 6·95 dwt. went to the mills. The yield by amalgamation was 154,433 oz., and by cyanide 77,407 oz., the total being 231,840 oz.,

or 6⅝ dwt per ton. The revenue was £972,440, or 27s. 11d. per ton, and the working cost £623,410, or 17s. 11d. per ton, leaving a profit of £349,030, or 10s. per ton. In addition, £81,061 was spent on capital account on electrification and the provision of further plant. Of this, £50,499 has been paid out of the year's profits. Government taxes absorbed £29,964, and £280,000 was paid as dividend, being at rate of 40%. During the year 14,324 ft. of development was done, disclosing 729,012 tons of ore averaging 6·4 dwt. On December 31 the reserve stood at 3,670,160 tons averaging 6 dwt. The upper levels still contain a large amount of ore, and it is being extracted as rapidly as possible so as to minimize the risk of loss by caving.

**New Kleinfontein.**—This mine belongs to the Anglo-French Exploration group and is situated on the outcrop in the far east Rand. Edward J. Way is the consulting engineer. The report for 1911 shows that Mr. Way has abandoned his hostility to the tube-mill, and that four of them together with additional cyanide plant are now being erected. A year ago we recorded that the central and western parts of the property had been developing in an unsatisfactory manner; also that additional ground had been purchased from the Orient syndicate. Mr. Way now reports that the Orient property is giving good results, and that in the central section of the Kleinfontein a higher grade of ore is being found. Consequently, though the ore developed in the western section is of low grade, the average grade of the ore reserves on December 31 was practically the same as a year before. During the year 1911, the ore mined totalled 572,021 tons, and after the removal of 21% waste 451,145 tons was sent to the mill. By amalgamation and cyanidation 158,372 oz. worth £673,240 was recovered, being at the rate of 7 dwt. or 29s. 10d. per ton milled. The working cost was £418,478, and the profit after deducting charges for the realization of the gold was £245,763 or 10s. 10d. per ton. For 1910, the yield per ton was 28s. and the profit 12s. Taxes and depreciation brought the profit for 1911 to £205,965, out of which £169,750 was paid as dividend, being at the rate of 17½%, as compared with 22½% in 1910 and 25% in 1909. Of the balance £27,031 was devoted to capital expenditure on shaft-sinking and new plant. For the purposes of extending operations, money has been borrowed from the Standard Bank of South Africa to the extent of £174,000. The ore reserve on December 31 was calculated at 1,607,015 tons averaging 6·4 dwt., as compared with 1,397,412 tons averaging 6·46 dwt. at the end of 1910 Much of the recent increase in costs is due to the scarcity of labour.

**Modderfontein B.**—This company belongs to the Rand Mines group and owns a deep level property in the far east Rand immediately adjoining the Brakpan. The performances of the two properties will be watched with interest, as they started production at practically the same time. The lode at Modderfontein B is flat, and H. Stuart Martin, the consulting engineer, has laid out the development and mining work on lines similar to those adopted in collieries. The metallurgical plant, consisting of 80 stamps, 5 tube-mills, cyanide plant and Butters filters, started at the end of September, and after a month of trial runs, continued uninterruptedly from the first of November. During the 71 days, 87,439 tons was raised and, after the removal of 10% waste, 77,960 tons was sent to the mill. The stamp duty was 13·7 tons per day. The assay-value of the feed was 9 dwt. and of the final tailing 0·5 dwt. The yield by amalgamation was 15,178 oz., and by cyanide 15,740 oz., a total of 30,918 oz., or 7·93 dwt. per ton milled. The revenue was £129,818, or 33s. 3d. per ton; the working cost £80,997 or 20s. 9d. per ton; and the working profit £48,820 or 12s. 6d. per ton. The grade of ore sent to the mill was higher than the average of the mine. The policy of developing the richer blocks first was adopted purposely, so as to compensate for the higher expenses always incurred when starting production at a mine. During the year, 13,346 ft. of development work was done; of this, 6909 ft. was on the lode which assayed on an average 26·9 dwt. over an average width of 11 in. In stoping, a width of 51 in. has been adopted. The blocks of ore reserve measure 1000 by 800 ft., and the profitable reserve is estimated at 2,355,700 tons averaging 7½ dwt. In addition, there are blocks estimated to contain unprofitable ore to the extent of 1,173,100 tons averaging 2·4 dwt. The greater part of the plant has been built on ground above un-




*THE FAR EAST RAND.*

profitable blocks. The hanging wall is weaker than is usual on the Rand, and a systematic method of timbering and rock-walling has been adopted. The capacity of the plant is 31,000 tons per month.

**Durban Roodepoort Deep.** — This mine in the middle west Rand belongs to the Rand Mines group. Milling started in 1898, but no dividend was paid until 1908. The cost has always been high, for various reasons, owing chiefly to irregularity of the ground and to the water difficulty. The conditions during 1911 have been adverse. A serious crush occurred in the early part of the year in No. 2 shaft and the pump-columns were injured. For some time the lower levels were in consequence flooded. Much time and money were spent in re timbering and improving the shaft and in repairing the pumps. Nevertheless 14,938 ft. of development work was done during the year, an increase of 3296 ft. over 1910. The ore reserve on December 31 was estimated at 1,288,071 tons averaging 6·8 dwt. over 48 inches, being an increase of 226,094 tons during the year. The amount of ore raised was 327,171 tons, and after the removal of 20% waste, 262,540 tons went to the mill. The yield by amalgamation was 62,176 oz., and by cyanide 28,740 oz., making a total of 90,916 oz., or 6·93 dwt. per ton. The revenue was £380,629, or 29s. per ton ; the working cost £319,795, or 24s. 4d. per ton ; and the working profit £60,834, or 4s. 8d. per ton. In addition, £36,247 was expended on capital account, chiefly on electrification plant ; of this, £31,437 was provided out of current revenue. The dividend absorbed £22,000, being at the rate of 5 per cent.

**Ducktown Sulphur, Copper, and Iron.**—This company was formed in London in 1891 to acquire pyrite mines in Tennessee, and has paid dividends continuously. Two years ago a large sulphuric acid plant was built, and mining operations have also been greatly extended, the most important work having been the opening up of another part of the deposit at the Mary mine by means of a new shaft. The report for 1911 shows that from the Mary and East Tennessee mines, 145,688 tons of ore was raised, yielding 2520 tons of copper, as compared with 128,586 tons and 2200 tons in 1910. Also 45,625 tons of sulphuric acid was made, as compared with 46,500 tons. The profit was £33,408, and after the allowance of £2000 for depreciation, and the payment of £5449 as interest on debentures, the divisible profit was £25,958. Out of this £19,980 was distributed to ordinary shareholders, being at the rate of 10%, and £5994 was paid on the founders' shares.

**Tekka.**—This company belongs to the Wickett group, operating alluvial tin mines in the Federated Malay States. The offices are in Redruth, and the directors and shareholders are mostly Cornishmen. Osborne & Chappel are the managers. The fifth annual report now published covers the year ended January 31 last, and shows that 625,844 cubic yards of gravel was treated, yielding 419 tons of black tin, a recovery of approximately 2 lb. per cubic yard. The quantity of gravel treated was 197,028 cu. yd. less than in the previous year, and the yield 14·7 tons less. Owing, however, to the advance in the price of tin, the income was £6453 greater, the figure being £46,599. The mining cost was £13,620, and income tax absorbed £1057. The expenses in England were £560. The divisible profit was £32,276, out of which £26,741 has been distributed as dividend, being at the rate of 35%. The smaller amount of gravel treated is explained by the fact that more water is now required for elevation purposes. During the year the Taiping property has been acquired, and work was started in December.

# TRADE NOTES

*Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.*

**The Lane Slow Speed Mill Co.** are distributing a circular describing the operation and working costs of one of their Chilian mills at Cue, Western Australia.

**The National Pulverizer Co.** announce the purchase of the Samson Manufacturing Co., including patent rights, title, and good-will in the Samson Rock Crusher.

**F. W. Brackett & Co., Ltd.,** have sent us a bulletin of four pages describing the Elmore Sampler for Mill Pulp; also a 16-page bulletin giving prices and details concerning their air-compressors.

**H. R. Marsden Ltd.'s** List 100, issued in English, French, and Spanish (16 pages, 8½ by 11½) describes the Stone Breakers and Ore Crushers manufactured by this old firm. Prices and shipping weights are also given.

**The British Humboldt Engineering Co.** report the sale of a Multiple-Hearth Roasting Furnace to be erected at the Straits Trading Co.'s works near Singapore. This furnace is a duplicate of the one installed at the Falmouth Consolidated in Cornwall.

**Keystone Driller Company** have just issued their 1912 edition catalogue describing their Deep Well Pumps. The catalogue (8 by 11 inches, 78 pages) contains not only accurate information on elevating large quantities of water from artesian wells, but also numerous tables of Pressure, Capacity, etc.

**The Parker Rotary Drill** has been credited with some remarkable performances for speed in drilling oil-wells. The drill is worked under the 'mud-flush' system, by which a constant circulation of thick mud holds up the walls of the bore until the depth required has been attained. Drilling is thus not retarded by the necessity of closely following the boring tool with casing. It is claimed that the rotary motion makes a perfectly round hole and does not disturb the walls. Messrs. Gillespie & Co., of 2 Whittington Avenue, London, E.C., are the European Agents.

**'Mine & Quarry'** is the monthly bulletin of the Sullivan Machinery Co. The March issue has just come to hand and contains the usual carefully compiled matter relating to the products of this company. *Mine & Quarry* has been the 'House Organ' of the Sullivan Machinery Co. for five years, and has proved useful in keeping engineers in the field in touch with the latest compressed-air installations. In addition to this periodical the firm publishes regular bulletins on particular machines such as No. 63 F describing the Sullivan Continuous Coal Cutter, which is now being distributed.

**The Secretariat International du Carbure de Calcium** offer a prize of 5000 francs to the inventor of the first Acetylene Safety Lamp for use in mines where fire-damp is present, which is submitted and approved by the Explosives Department of H.M. Home Office by March 31, 1913. The weight and price of the lamp must be such as to permit its being used in a practical way as a portable lamp. If several lamps are approved by the Board of Trade at the same time, the prize will be distributed to the inventor of the lamp offering the maximum technical and practical advantages. Competitors should send all documents (detailed description with drawings, Board of Trade authorization) to the Secretariat International du Carbure de Calcium, 5, Rue des Granges, Geneva.

# The Mining Magazine

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*Scientia non habet inimicum nisi ignorantem.*

T. A. RICKARD, Editor. EDGAR RICKARD, Business Manager.

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# STATISTICS

### Stocks of Copper in England and the Continent.
Reported by Henry R. Merton & Co.

| | Mar. 30 Tons | April 30 Tons | May 31. Tons |
|---|---|---|---|
| In England | 35,732 | 34,686 | 30,629 |
| In France | 6,418 | 6,035 | 5,259 |
| Afloat from Chile | 2,325 | 2,050 | 1,800 |
| Afloat from Australia | 5,700 | 7,000 | 6,900 |
| In Rotterdam | 3,300 | 2,750 | 1,750 |
| In Hamburg | 7,600 | 7,371 | 6,252 |
| Total European visible supply | 61,075 | 59,892 | 52,590 |

### American Copper Producers' Association.
In Tons of 2,240 lb.

| | Production. | Deliveries | | | Stocks at end of month |
|---|---|---|---|---|---|
| | | Domestic | Foreign | Total | |
| October 1911 | 52,792 | 28,602 | 26,832 | 55,425 | 60,267 |
| November | 49,945 | 30,375 | 29,932 | 60,307 | 49,905 |
| December | 54,865 | 29,459 | 35,374 | 64,833 | 39,937 |
| Total, 1911 | 639,258 | 316,791 | 337,009 | 653,800 | — |
| January 1912 | 53,272 | 27,832 | 35,789 | 63,621 | 29,589 |
| February | 51,801 | 25,101 | 28,191 | 53,292 | 28,098 |
| March | 56,114 | 30,128 | 26,241 | 56,369 | 27,843 |
| April | 56,011 | 31,033 | 23,773 | 54,806 | 29,048 |
| May | 56,570 | 32,456 | 31,020 | 63,476 | 22,142 |

### Production of Gold in the Transvaal.

| | Rand | Elsewhere | Total | Value. |
|---|---|---|---|---|
| | Oz. | Oz. | Oz. | £ |
| July 1911 | 679,881 | 29,377 | 709,258 | 3,012,738 |
| August | 682,405 | 31,002 | 713,407 | 3,030,360 |
| September | 669,773 | 30,852 | 700,625 | 2,976,065 |
| October | 677,923 | 30,721 | 708,644 | 3,010,130 |
| November | 291,466 | 28,267 | 719,729 | 3,057,213 |
| December | 680,782 | 29,126 | 709,908 | 3,015,499 |
| Totals, 1911 | 7,896,802 | 340,921 | 8,237,723 | 34,991,620 |
| January 1912 | 709,280 | 27,780 | 737,360 | 3,130,830 |
| February | 674,960 | 28,906 | 703,866 | 2,989,832 |
| March | *796,755 | 33,968 | *830,723 | *3,528,688 |
| April | 706,763 | 30,897 | 737,660 | 3,133,383 |
| May | 746,948 | 32,714 | 799,662 | 3,311,794 |

* Including 70,143 oz. worth £297,946 extinguished reserve.

### Cost and Profit on the Rand.

| Month. | Tons | Yield per ton | Costs per ton | Profit per ton | Total profit |
|---|---|---|---|---|---|
| | | s. d. | s. d. | s. d. | £ |
| 1911 | 23,888,260 | 27 7 | 18 0 | 9 7 | 11,414,863 |
| January 1912 | 2,067,161 | 27 6 | 18 10 | 8 11 | 997,557 |
| February | 1,980,396 | 28 3 | 19 2 | 9 2 | 907,192 |
| March | 2,163,998 | 28 1 | 18 11 | 9 0 | 1,204,764 |
| April | 2,059,562 | 28 6 | 19 0 | 9 8 | 1,005,920 |

### Natives Employed in the Transvaal Mines.

| | Gold mines | Coal mines | Diamond mines | Total |
|---|---|---|---|---|
| July 31, 1912 | 181,582 | 8,122 | 11,054 | 200,758 |
| August 31 | 179,810 | 8,182 | 11,292 | 199,284 |
| September 30 | 179,619 | 8,045 | 11,475 | 199,139 |
| October 31 | 179,194 | 8,078 | 11,319 | 198,591 |
| November 30 | 176,736 | 8,043 | 10,071 | 194,850 |
| December 31 | 178,282 | 8,053 | 8,914 | 195,249 |
| January 31, 1912 | 184,046 | 7,805 | 9,524 | 201,375 |
| February 29 | 190,320 | 7,922 | 10,789 | 209,301 |
| March 31 | 196,748 | 8,198 | 12,071 | 217,017 |
| April 30 | 197,937 | 8,364 | 13,785 | 220,086 |
| May 31 | 193,829 | 8,460 | 14,538 | 216,827 |

### Gold Output of India.

| Year 1910 | Year 1911 | May 1912 | Year 1912 |
|---|---|---|---|
| £2,104,858 | £2,150,050 | £188,637 | £928,471 |

### Production of Gold in Rhodesia.

| Month. | 1908 | 1909 | 1910 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| January | 199,388 | 204,666 | 227,511 | 214,918 |
| February | 191,635 | 192,497 | 203,888 | 209,744 |
| March | 200,615 | 202,157 | 228,385 | 215,102 |
| April | 212,935 | 222,700 | 228,213 | 221,476 |
| May | 223,867 | 225,032 | 224,888 | — |
| June | 224,920 | 217,600 | 214,709 | — |
| July | 228,151 | 225,234 | 195,233 | — |
| August | 230,792 | 228,296 | 191,423 | — |
| September | 204,262 | 213,249 | 178,950 | — |
| October | 205,466 | 222,653 | 234,928 | — |
| November | 196,668 | 236,307 | 240,573 | — |
| December | 217,316 | 233,397 | 199,500 | — |
| Totals | 2,526,007 | 2,623,788 | 2,568,201 | — |

### Production of Gold in West Africa.

| Month. | 1910 | | 1911 | | 1912 | |
|---|---|---|---|---|---|---|
| | Oz. | Value | Oz. | Value | Oz. | Value |
| | | £ | | £ | | £ |
| January | 17,357 | 70,699 | 15,903 | 66,107 | 26,098 | 107,262 |
| February | 16,976 | 68,469 | 15,179 | 63,081 | 25,009 | 102,270 |
| March | 17,627 | 71,954 | 16,387 | 67,673 | 27,228 | 111,376 |
| April | 16,363 | 67,069 | 17,237 | 70,880 | 27,790 | 114,796 |
| May | 16,590 | 68,355 | 24,427 | 96,409 | — | — |
| June | 17,194 | 70,988 | 22,555 | 92,174 | — | — |
| July | 15,564 | 58,551 | 22,510 | 91,955 | — | — |
| August | 13,921 | 57,713 | 25,385 | 103,753 | — | — |
| September | 11,497 | 47,746 | 26,717 | 109,039 | — | — |
| October | 13,341 | 55,046 | 26,826 | 109,503 | — | — |
| November | 14,021 | 57,658 | 24,289 | 99,299 | — | — |
| December | 15,042 | 61,737 | 24,369 | 99,569 | — | — |
| | 185,493 | 755,985 | 261,784 | 1,069,442 | — | — |

### Production of Gold in Western Australia.

| Month. | Export oz. | Mint oz. | Total oz. | Total value |
|---|---|---|---|---|
| | | | | £ |
| Total, 1910 | 363,496 | 1,209,856 | 1,573,352 | 6,682,042 |
| Total, 1911 | 160,021 | 1,210,447 | 1,370,468 | 5,823,522 |
| January 1912 | 10,697 | 95,673 | 106,370 | 451,828 |
| February | 10,441 | 92,091 | 102,532 | 435,526 |
| March | 408 | 92,597 | 93,005 | 395,058 |
| April | 10,698 | 99,708 | 110,406 | 468,972 |
| May | 9,288 | 98,104 | 107,392 | 456,170 |

### Other Australasian Gold Production.

| | 1910 | 1911 | May 1912 | 1912 |
|---|---|---|---|---|
| | £ | £ | £ | £ |
| Queensland | 1,840,337 | 1,623,390 | 139,350 | 615,920 |
| New South Wales | 803,727 | 769,353 | 86,160 | 295,171 |
| New Zealand | 1,896,322 | 1,808,049 | 191,620 | 734,052 |
| Victoria | 2,422,700 | 2,138,000 | 133,752* | 596,952* |

* April figures only.

### Sale of Tin Concentrate at Redruth Ticketings.

| | Tons | Value | Average |
|---|---|---|---|
| Year 1911 | 6151¼ | £702,599 | £114 4 5 |
| Jan. to April 1912 | 2212 | £263,116 | £118 19 0 |
| May 13 | 227½ | £29,380 | £129 2 10 |
| May 28 | 286¾ | £36,653 | £128 0 11 |

### Exports of Tin and Ore from Straits and Bolivia.
Reported by A. Strauss & Co.

| | 1911 tons | May 1912 tons | 1912 tons |
|---|---|---|---|
| Metal from Straits to Europe and America | 55,135 | 5,760 | 24,393 |
| Metallic Content from Bolivia to Europe | 22,577 | 1,460 | 7,807 |

# REVIEW OF MINING

INTRODUCTORY.—The end of May settlement was marked by obvious nervousness, due to the severe liquidation following upon wild gambling in Marconi, steamship, and other shares. None of them represented mining, but the bad account had its inevitable effect on all departments. If the mining market had not been in a quiet state, the damage would have been greater. On the whole, however, the tone improved during June. Kaffirs give recurrent signs of slight revival, owing largely to the excellent results yielded by the mines in the far eastern portion of the Rand. Another encouraging feature is the reported effort to bring the financial groups into agreement in regard to methods of recruiting for native labour. The Nigerian tin gamble received its quietus for a time when the Anglo-Continental fiasco was exposed. It has been proved, however, that the public is ready to speculate in mines and that tin can be extracted profitably in Nigeria, if ordinary sense and honesty are brought to bear. Copper shares are buoyant, by reason of the continued improvement in the statistical position. High prices for the base metals are stimulating the search for them, as was foreseen in these columns several months ago. Siberian enterprises continue to engage attention, and worthily. Mexican mining is dead for the time being, owing to the failure of the Government to maintain order. Labour troubles are affecting several mines in New Zealand. Pleasant developments continue at Broken Hill and good news is forthcoming from Queensland. On the whole, the outlook for the moment is not displeasing. What is needed is the discovery of a new mining district to revive general speculation, and to renew public interest in the world-wide exploitation of ore deposits.

TRANSVAAL.—The April returns, although they showed a smaller output of gold, owing to the 30-day month, were satisfactory. The yield was 5d. per ton better and the cost only 1 penny per ton more than in March. Hence the so-called profit (of which 75% is real profit) was 4d. higher. The total yield was 737,660 ounces of gold worth £3,133,383; that for May is announced as £3,311,794, an increase of £178,411, due mainly to the additional day.

The April labour statistics were not unsatisfactory, as the gain was 1189, making the total 197,937, as against 194,328 a year previous. From December to April the increase was 21,101; this would be important if it could be held. Unfortunately the period of native migration is about to begin and a loss in supply is bound to recur. In May the loss was 4108, as compared with April.

On May 17, the absorption of the Ferreira by the Ferreira Deep was duly ratified. The 'profit' made by the Brakpan in May is the best as yet recorded for that mine, being £40,300, as against £31,000 in April. The East Rand advance in profit for May is due to an increase of 9d. per ton in the working cost, the yield remaining at 34s. per ton. The Meyer & Charlton maintains the high level of profit recently established.

The summary of the speech of the Chairman of the Rand Mines appears to be couched in a cheerful tone. Reforms on surface and improvements underground are proving effective.

At the annual meeting of the General Mining and Finance Corporation, Sir George Albu deprecated pessimistic apathy in regard to Rand mining as not being warranted by hopeful facts within his cognizance. Unfortunately, however, he had to dispel the cheerful idea that the controlling groups had agreed to co-

operate on the labour supply, for he said it was "now extremely doubtful whether any satisfactory arrangement would result owing to the impossible proposals put forward by certain groups." This shows an obtuse disregard of a serious weakness in Rand economics.

RHODESIA.—The April statistics showed a gain of 1515 ounces as compared with March, the total being 52,587 ounces, worth £221,476. But no real increase in production is being made; in April last year the output was worth £221,296; in the corresponding month of the three previous years it was £228,213, £222,700, and £212,935 respectively. With all the company-mongering and flamboyant talk of reckless promoters the advance of Rhodesia as a gold-producing country is negligible. The mining is mostly in London. The returns as published give the profit per ton at individual mines, but the so-called 'profit' is an illusion, for only a fraction of it is real profit, in the sense of actual dividends.

The reported settlement of differences between Sir Abe Bailey and the Gold Fields group is supposed to have helped the Rhodesian market. On the other hand, the scarcity of water is hindering milling operations. Good progress is being made with the branch line to the Shamva mine, but delays have occurred in the delivery of rails. Foundations have been laid for the Mazoe bridge, the completion of which is the chief item in the construction of this railway.

Among the mines in the making may be mentioned the Golden Kopje, a banded ironstone deposit, resembling the Connemara at Hunter's Road and the Redrups Kop near Bulawayo, and not unlike the Wanderer mine at Selukwe. All of these may be described as masses of ferruginous shale, with pyrite in seams parallel to the foliation, the entire mass intersected by quartz veins, and all of it variously enriched by gold.

The mortality from pneumonia and scurvy among the natives employed on the mines has decreased notably, owing largely to better food.

The Tanganyika Concessions remains in its former position of an unsolved riddle. We cannot say that the mission of Messrs. Jules Jadot and Sheffield Neave to Katanga has impressed us as in any sort conclusive. They are said to have confirmed the value of the Star of the Congo and Kambove mines, but the 'value' of these mines, after all, depends upon the economic treatment of the ore. No real progress can be made until the English and Belgian directors unite in recognizing this basic fact, and recognize it in a practical way by engaging the very best metallurgical specialist available. So far no real progress has been made, and much money has been spent in mere experiments. The energy of Mr. Robert Williams and the patient investigation of Mr. Sheffield Neave are insufficient for the purpose, which is to turn copper ore in Central Africa into sovereigns in Brussels or London. Meanwhile, the technical control appears to be shifting to Brussels, Mr. Robert Williams being now a member of a technical committee of four, two British and two Belgian. A general manager is to be chosen. This is the man who can make or mar the enterprise. We earnestly hope that only a man of first-class ability and experience will be appointed. Of men fitted to tackle the Tanganyika the number is less than the fingers on one hand.

WEST AFRICA.—The returns issued by the Chamber of Mines for April were notable in recording a maximum gold output and in giving a list of production of individual companies. The total yield of gold was worth £114,796, an increase of £43,916, as compared with April 1911, and £3420 as compared with March 1912. This increase is due to the Broomassie and Prestea mines. The Ashanti Goldfields, however, continues to be the largest and most consistent producer.

Lord Harris's belated comment that "we must recognize that mining on the banket of

the Gold Coast is not what mining on the banket of the Rand is," is said to have chilled the Jungle, but it seems to be a harmless remark at this late date. It would have been interesting two years ago.

Work has been suspended by the Fanti mines owing to lack of funds, but a bore-hole is being sunk. The Abbontiakoon's consulting engineer reports favourably concerning the width and richness of the lode in the deepest workings, and it is announced that the mill is about ready to start. This mine is estimated to have 643,000 tons of 10-dwt. ore ready for stoping. At the Prestea also the additional stamps are shortly due to start.

Several references to the Anglo-Continental affair will be found elsewhere in this issue. The essential facts are now known. It is a mere prospect. We note with pleasure that Mr. W. R. Rumbold has been appointed consulting engineer and that a clean sweep has been made of the staff. By electing Mr. E. W. Janson as a director, the board is strengthened, for he is a mining engineer of the highest repute. More resignations are announced in consequence of unpleasant incidents. Thus Mr. L. H. L. Huddart, who previously left the Benue, has also surrendered his appointment as consulting engineer to the Champion Tin Fields, Ltd., on account of a circular against which he had previously protested. Messrs. Lake & Currie have resigned as technical advisers to the Nassarawa and Ninkada companies, for reasons not published.

Alluvial returns from Nigeria are scanty owing to the lack of water, but they are not worse than in April. At the Naraguta Extended the overburden has been removed and the manager expects to maintain an output of 45 tons of tin concentrate per month.

AUSTRALASIA.—The moulders' strike at Kalgoorlie has been settled, and the mines are no longer bothered by lack of foundry supplies. Our Melbourne correspondent has further interesting remarks on labour and politics.

It is not often that a manager cares to say what dividends a mine will pay, for that is apt to depend on circumstances beyond his technical control. We note with interest, therefore, that Mr. Richard Hamilton asserted recently that the Great Boulder Proprietary would pay " at least the present price of the shares (12s.) in dividends if no more ore is found by future prospecting work."

At the Great Fingall the exploratory work on the 18th level confirms the favourable evidence obtained on the 17th level. About 20,000 tons of ore has now been opened up in the new deep workings. This reserve will not be available for the mill until the new internal shaft, being sunk in the foot-wall from the 13th level, has been completed to the 18th level. This will be done by the end of the year. The bottom workings in the Sons of Gwalia prove the persistence of the main ore-body, which has been disclosed by bore-holes and cross-cuts penetrating the hanging wall of the main level. The downward continuation of the ore-shoots in the western portion of the mine is also being demonstrated satisfactorily, so that the general position is excellent. The Great Fitzroy has resumed concentrating and smelting; no decisive results are yet to hand.

A hopeful report by the Bullfinch Proprietary draws attention to a famous fizzle now the object of serious mining operations. The 500,000 shares were quoted at £3½ not very long ago; they are now at 11s. 6d. Even at that price they are high, for the 70,000 tons, which may yield 25 to 30s. gross profit per ton, represents only about £100,000, as against a market valuation of £287,500.

Developments in the Blackwater mine are said to be excellent. Mr. G. A. Morrison is now manager. An option has been taken on a neighbouring claim, the Snowy River Extended, which is to be tested forthwith. We understand that all three of the properties belonging to the Consolidated Gold Fields of New Zealand, namely, the Blackwater,

Progress, and Wealth of Nations, are developing most satisfactorily.

The Mount Lyell has acquired the Comstock mine, into which some of the known orebodies appear to pitch. The Lady Margaret water-power scheme was endorsed at a recent shareholders' meeting. This will involve an expenditure of £140,000 and will require two years, if sufficient labour becomes available. The higher price for copper is proving of notable benefit to the Mount Morgan; this has lately been accompanied by an increased yield of gold from a smaller quantity of gold ore; hence the total production exhibits a decided improvement.

On May 14 it was announced that the miners working at the Waihi and the Waihi Grand Junction mines had laid down their tools owing to the engine-drivers having formed a separate union. The Miners' Union objected to this new union and called out all the men in order to compel the engine-drivers to rejoin the older labour organization. On June 11 it was stated that the Government had registered the engineers' union, and the strike continues. On May 20 it was stated that the miners working on the Blackwater, Progress, and Wealth of Nations mines, all controlled by the Consolidated Gold Fields of New Zealand, had struck work, necessitating the closing-down of the mills. Negotiations for a settlement are pending.

The annual report of the Zinc Corporation is published. It includes a special general review of the company's position, by Mr. Theodore J. Hoover, who has recently returned from Broken Hill. We understand that 2,200,000 tons of tailing remain to be treated and that the ore reserve in the South Blocks mine amounts to over 1,000,000 tons; also that the entire change in the method of treatment during the last twelve months has enabled the company to earn undiminished profits on material containing 20% less zinc than was possible formerly.

CANADA.—On June 6 a fire, starting at the Lyric theatre, destroyed a large part of the town of Cobalt. Fortunately this catastrophe did not happen in winter. We feel sure that the enterprising men who made Cobalt synonymous with wealth in silver will rise to the occasion and re-build so promptly that only the improvement will call for further remark. From Porcupine nothing of particular interest is forthcoming. The Hollinger mill ought to have started ere now. Accidents to three out of four tube-mills have prevented the Dome mill from attaining its full capacity. A 20-stamp mill has been ordered for the McIntyre, to be added to the 10-stamp mill, now crushing. The West Dome has been idle for lack of fuel.

A gold rush to Whiskey Lake is to be chronicled. This locality is 40 miles north of Massey, a station on Sault Ste. Marie branch of the Canadian Pacific. Jack Wilson, the discoverer of the Dome, at Porcupine, is at the head of the movement. Promising finds of copper and gold are said to have been made.

From Dawson we learn that Mr. A. N. C. Treadgold has effected another consolidation called the Canadian Klondike Company. This comprises the holdings of the Canadian Klondike Mining Co., usually known as the Boyle Concession, in the valley of the Klondike; also the Bonanza Basin, which adjoins the lower end of the Boyle Concession and extends to the confluence of the Klondike with the Yukon river; also the Hunker Development Co. and the Granville Power Co. At present two dredges are at work on the Boyle Concession; three more 16-cu. ft. dredges have been ordered by the new company, in the expectation of getting them to work this season. Mr. Joseph Boyle is the general manager.

UNITED STATES.—Wall Street is inclined to be cheerful. Politics has lost its terrors for the moment, and the candidacy of Mr. Roosevelt is accepted with equanimity. Crop prospects are good. Consumptive demand is stimu-

lating the copper, steel, and oil markets. The advance in copper to 17¼ cents per pound, the highest price attained since the summer of 1907, has cheered all the copper producers and is an indication of general expansion in American industry. The Amalgamated Copper Co.'s report shows that the average cost of production in 1911 was the lowest recorded. Our San Francisco correspondent gives the latest information concerning several other important copper enterprises.

The re-opening of the old Plymouth mine, in California, is progressing rapidly. The water had been lowered to 1030 ft. in the main shaft on May 18, and the shaft itself has been found in excellent preservation. At 950 ft. the first old level was found to be in good condition for 1400 ft. The bottom of the mine is at 1700 ft. The Beebe mine, at Georgetown, El Dorado county, has also been taken under option by Bewick, Moreing & Co.

MEXICO.—The position is obscure, for reliable news is scanty. In the North the Federal troops under General Huerta appear to have beaten the *revoltosos* under Orozco, who is in retreat. The rebel administration of Chihuahua is discredited. Madero seems to be winning, and the pacification of the country is almost in sight. The Chamber and Senate have agreed in voting the 20,000,000 pesos required to increase the army to 60,000 men. Without a strong standing army the Government cannot maintain order. Voluntary regiments are also being formed in support of the constitution. Undoubtedly the threat of American intervention has hastened measures too long delayed. Public opinion is rallying to the Madero government in its belated effort to stamp out lawlessness masquerading as political unrest. As soon as order is fully restored we expect to see a notable expansion of the mining industry in Mexico. Meanwhile we have lost touch with our regular correspondent, who is in the disaffected area. We publish a timely article by Mr. Frank Oldfield.

The revolution has not hindered operations at the Santa Gertrudis, near Pachuca. Another level will soon be opened up, for the San Guillermo shaft and a winze have both been sunk to the 19th level. A break in the pump-line has retarded cross-cutting. The mill is being enlarged from 600 to 800 metric tons daily. In the Esperanza, at El Oro, the exploratory work on the San Carlos vein is meeting with the varying results anticipated. The mill is running uninterruptedly. At the Palmarejo, in Chihuahua, work has been stopped, the mine being closed down, pending the restoration of law and order. In this part of Mexico the disorder is at its worst.

RUSSIA.—The Tanalyk Corporation is a company formed on the initiative of Mr. Leslie Urquhart, managing director of the Kyshtim Corporation. It recently acquired a series of abandoned copper mines in the South Ural region. The shallow workings, then under water, were found to give evidence of ore-bodies well worthy of being tested systematically. The copper ore was found to contain gold also. According to agreement with the Russian vendors, it became necessary to form an English company with £50,000 working capital. This, and an equal amount subject to call, was subscribed in London. Since then the shares have appreciated in consequence of Russian buying. Mr. R. Gilman Brown is on his way to make an inspection.

Mr. Brown will also be issuing his annual report as technical director of the Kyshtim. A third blast-furnace has been blown-in, while one of the other two is being re-jacketted. Developments underground are proceeding with most satisfactory results, a noteworthy feature being the gold content found in a band of quartzitic material on the hanging wall. This serves as an economic silicious flux. The blister copper shows an increase in gold, from £12 per ton in 1911 to a maximum of £19 per ton during several months of the year.

The Spassky meeting was an agreeable

function. A strong financial position was disclosed. The debenture debt has been extinguished and a final dividend of 1s. 6d. is declared on the year's work. In July an interim dividend of 2s. is assured. So far, profits have come from the Yusspensky copper mine alone, and it will be remembered that the Spassky company owns a controlling interest in the Atbasar, which promises to be a most remunerative undertaking.

Shares in Lena Goldfields have been depressed on the statement that the Lenskoie, the Russian operating company, would make the dividend for the past year only 135 roubles, as against 252 roubles last year. This decrease is said to be a precaution against losses arising from the strike, with its attendant complications. About half the usual force of workmen is now employed. A commission, appointed by the Government, is on its way to the mines, with the purpose of making an inquiry that may lead to a settlement of the trouble.

We are informed that Mr. G. Benenson, whose name we mentioned before in connection with the Sissert Estates, has exercised the option he held on that property, and we understand that a Russian company has been incorporated and is now at work. This company is called the Sissert Mining District.

INDIA.—The progress reports coming from the Champion Reef have recently afforded pleasant reading to shareholders. At quite a number of different points the developments continue to disclose highly profitable ore. For instance, on the 36th level south from Garland's shaft the lode assays 2½ oz. over 2 ft. of ore, and in the 37th level south of the Glen shaft the lode assays 53 dwt. over 2½ ft. The general tone of the reports is reminiscent of the old days before the workings came to the poor zone. The reports from the North Anantapur are also encouraging and show that profitable orebodies are being developed. The last fortnightly report to hand mentions that at 450 ft., the level is being driven in ore that averages 1 oz. over 5 ft. The No. 3 winze below this level has been sunk 43 ft. and the lode is 1 ft. wide assaying 1 oz. The No. 1 winze below the 200-ft. level north is down 61 ft. in ore 3 ft. wide and assaying 1 oz. per ton. In a winze sunk to connect the 130-ft. and 250-ft. levels, the lode is 6 ft. wide and assays 1½ oz. per ton.

VARIOUS.—The Aporoma, in Peru, publishes its first clean-up, namely, 46 ounces of gold from the washing of 6000 cubic yards of upper gravel, showing an average yield of 7 pence per yard as against the 10d. per yard estimated. The manager explains that "the whole thing amounts to a preliminary trial, owing to scarcity of rain." It is planned to increase the water storage.

In October 1911, it was stated in this magazine that the Tronoh mine was making an abnormal output owing to the fact that the submanager was depleting the rich ore held in reserve against a rainy day—literally and figuratively. In the annual report recently issued it is stated, in explaining the phenomenal output last summer, that the mine at that time "was not worked in either the usual or a proper manner during the absence of the general manager, and that his instructions were not carried out." It is announced that Mr. Harry D. Griffiths, the manager, will apply hydraulicking methods to a large alluvial area not amenable to ordinary drift mining.

The news from various parts of Cornwall is encouraging. Messrs. John Taylor & Sons are undertaking the re-opening of the Droskyn and Wheal Ramoth near Newquay, and Messrs. Bainbridge, Seymour & Co. are contemplating similar work in connection with the Mulberry near St. Columb. The West of England Tin Corporation, a new company with which Mr. E. S. King is connected, has acquired the dumps at the Great Devon Consols, near Tavistock. Recent developments at Carn Brea & Tincroft have disclosed some useful high-grade ore.

# EDITORIAL

WHEN GOING to press we note that Sir Julius Wernher has willed further sums amounting to £150,000 to the Imperial College of Science and Technology. Also that he is succeeded as chairman of the Central Mining and Investment Corporation by Mr. Friedrich Eckstein.

IN MAKING an incidental reference, in our last issue, to the early history of the Great Boulder Proprietary, we stated that the enterprise was a "swindle." We regret the use of this term, which, we understand, has been interpretrated in a sense which we certainly never intended.

ON ANOTHER page we refer to the inadequate supply of native labour on the Rand. At the Central Mining meeting, Mr. F. Eckstein said that "the fatal mistake made by the Government of repatriating the Chinese becomes more evident every day." We wish the mistake could be rectified.

IN BELGIUM the Clericals have won the election against the Liberals. This is unfortunate for mining operators, for the church party is inclined to place excessive power in the hands of ignorant missionaries, who have no sympathy with the energetic men who are bent upon utilizing the mineral resources of the Congo.

A COMMITTEE representing the scientific societies of Cornwall has issued an invitation to the councillors and officers of other British technical and scientific societies to visit Cornwall in July. It is proposed to hold a joint meeting of representative men, the number being limited to 100. The official dates are from Tuesday, July 16, to Saturday, July 20. It is proposed to visit tin mines, dressing-floors, china-clay pits, and other engineering works, besides participation in sundry functions of less scientific importance but of intense social interest.

NOW that several British companies operating in Russia are doing so well that shareholders are glad to read the reports from the resident managers and the non-resident consulting engineers, it may be opportune to suggest that they should give dates according to the Gregorian not the Julian calendar, state money in pounds and shillings, not roubles and kopecks, use feet and yards, not sajenes and arshines, use pounds and ounces, not poods and dolis. The purpose of issuing reports is to give information; while meaning to do so, why not succeed in doing so?

THE PSEUDO-SCIENTIFIC piffle written, in the non-technical Press, concerning the Jemaa deposit recalls the old days when 'true fissure vein' was a term of vast and shadowy significance. Even at this late date we see it announced that "a true fissure lode has been struck on the farm Welgevonden, in the Waterberg district" of the Transvaal. So the Jemaa is said to be assured of "permanence," meaning persistence, because it is "a true lode." Suffice it to say that the shape of an orebody, or the receptacle it fills, does not indicate its mode of origin or the source of its valuable contents. A little geology is a dangerous thing on the Stock Exchange.

WORK at the Fanti Mines has been suspended. In March the ore reserves were stated to be: "Payable, 139,890 tons; value, 6·70 dwt.; non-payable, 224,430 tons; value, 3·95 dwt." Discarding the word 'pay-

able,' which is jargon, we find that the ore is divided into 'profitable' and 'unprofitable.' How unprofitable ore can have a "value," we do not know. In this case both classes of ore have no value, for neither will yield one penny of profit to the shareholders. The statement of so-called ore reserves is couched in untechnical terms, and we are not surprised that an incorrect terminology has served to obscure a pathetic fallacy. The correct use of technical terms is the first step to intelligent mining operations.

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IN CONTRAST to General Govett's remarks at the Ivanhoe meeting, we note, with pleasure, that Mr. F. S. E. Drury, the chairman of the Briseis, took pains to record his "high appreciation of the services so ably rendered" by the general manager, Mr. Lindesay Clark, and by his assistants at the mine. This acknowledgment was cheered and heartily endorsed by those at the meeting. At another meeting, that of the Spassky Copper Mine, the chairman, Mr. Arthur Fell, proposed "a vote of appreciation of the services" of the general manager, Mr. H. C. Woolmer, and the staff, both English and Russian. This proposal was supported in a delightful speech by Mr. F. H. Hamilton, a director of the company, who paid a tribute to the staff that will make them glad to be working, not *for*, but *with* such a board of directors. The references to the subject were closed with an appropriate mention of the loss of Arthur G. McCrae, the smelter superintendent, who went down with the *Titanic*, and a vote of condolence was transmitted to his relatives.

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AS our readers are aware, we publish every month statistics relating to the production of metals in various parts of the world. One of our tables gives the official figures for the monthly production, cost, and profit per ton milled on the Witwatersrand, and at the end of the several years we have quoted the averages. Like other people we accepted the official figures without demur, until we discovered that those relating to the averages for 1910 obviously contained an error, because the cost plus profit did not equal the yield. The figures were: yield per ton 28s. 6d., cost 17s. 7d., profit 10s. 6d. The addition of the second and third items gives 28s. 1d., as against 28s. 6d. in the official report. In order to obtain further enlightenment we consulted the year-book of the Transvaal Chamber of Mines for 1910, an elaborate red-bound volume containing a vast amount of information, and on examining the table analysing the monthly outputs, costs, and profits, we found that there is apparently an error which we call upon the Chamber to explain. The monthly figures for the yield per ton vary from 27s. 6d. to 28s. 6d., yet the average for the year is the latter figure, 28s. 6d. On checking the calculations for the year and the individual months, we find that the figures for the total output for the year divided by the total tonnage milled, give the average yield per ton correctly, but that similar operations on the monthly figures give results from fourpence to sixpence higher than the official ones. The higher figures when averaged corroborate the official yearly average. We have no means of pursuing our inquiries further, as the published tables do not help us.

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ONE of our weekly contemporaries, *The Statist*, publishes a letter from a 'Special Correspondent' who is evidently out of his depth, even in the shallow waters of Lake Porcupine. He says that the "Northern Ontario gold-bearing basin which stretches for a known distance of close on 200 miles, is composed of an eruptive rock known as keewatin, and the keewatin is one of the class of rocks which are of a friendly nature to gold, and it is located in a formation which again geologically is one of the oldest in the world." The grammar is as faulty as the geology. Such a lapse in

editorial revision may fairly be imputed to the Whitsun holidays. If the use of basin signifies anything, it is wrong. 'Keewatin' is not an eruptive rock; it is a geological terrain. No "class of rocks" is especially favourable to ores containing gold, except in specific localities, for specific structural or chemical reasons. The age of a rock formation bears not at all on its probable richness in gold. In Colorado, for example, the profitable gold and silver mines are found in rocks of every age, from the Pliocene to the Archean. At the conclusion of the same article it is said that, despite sundry conditions and results, "Porcupine has not yet had attractions for British investors. It is difficult to understand the apathy." Not to those who face facts. The reasons why Porcupine has proved unattractive are: first, evidence was lacking that profitable mining was likely except in two or three instances; secondly, the price of prospects was prohibitive; in frontier phrase, the ante was too big for the game.

THE RESIGNATION of Mr. Fischer Wilkinson, the Principal of the Cornish Mining School, has drawn attention to the misfortunes of an institution that seemed full of promise two years ago. Unfortunately its parlous state, from an administrative point of view, is aggravated at this time by the unpleasant notoriety acquired by the students. Cornish papers contain frequent paragraphs recounting cases of mining students arrested for being drunk and disorderly. Most of the offenders, we are glad to say, are not native to the county, but local opinion, already opposed to the idea of allocating further funds for the support of the School, is now less friendly than it ever was. Strong measures are required, although it may be admitted that the rustication of a score of students may seem to the governors impolitic at a time when the finances of the institution are precarious. The School has done good work in the past, and has proved itself well worthy of sustaining the Cornish tradition in mining, but unless it receives more support and attention from the leaders of local industry it seems destined to lose efficiency, character, and even a reason for existence. We were among those who thought, at one time, that it might develop into the chief college of mining in Great Britain, leaving to South Kensington the preliminary scientific training required for a specialized course, but that idea, much more that hope, must now be abandoned. However, the Empire can boast so few effective training colleges for mining and metallurgical engineers that we cannot afford to see the Camborne School degenerate into a bear garden.

RANDFONTEIN CENTRAL has not gained by the interviews, and corrections to interviews, with Sir Joseph Robinson as published in *The Financial News*. The latter confesses that the majority of the letters received from its correspondents on the subject are unsuitable for publication, "mainly owing to intemperance of language." That is readily to be surmised. What Sir Joseph knows about the Randfontein Central, what he does not know, and what he does not wish to be known, are all problems, the obscurity of which it is not profitable to penetrate. The interviews are contradictory and confusing, and even the financial editor's searchlight fails to do more than illuminate the fog that envelops Randfontein Central affairs. Meanwhile the dumps, formerly a prominent feature of the local topography, have vanished into the voracious bins of the big mill. This would seem to indicate an inadequate supply of ore.

SIR JULIUS WERNHER was known to be seriously ill so long that the announcement of his death was not unexpected, yet it made a profound impression. In him there passed away the survivor of a notable group of men whose operations are linked with the

history of mining in South Africa. Cecil Rhodes, Alfred Beit, Hermann Eckstein, and Julius Wernher were the founders of an industry that led to the mining, agricultural, and political development of a continental area. Rhodes was the master mind, but his imaginative temperament found keen sympathy in Beit: to the other two of the famous quartette it was left to contribute the sagacity and acumen required to turn expansive schemes into sound business ventures. Those ventures have developed into enormously profitable enterprises, such as the De Beers, Rand Mines, and Central Mining corporations. It is a final proof of Sir Julius Wernher's prescience that he transferred the holdings of his own firm to two of these big holding companies so long before he was called by Death that his decease caused not the slightest complication. Of his broad public spirit, of his generosity to the cause of education, and of his keen appreciation of the obligations incidental to financial power, it is not necessary to speak. The memory of them will be cherished in the works he has left as a memorial to a great career.

## South African Legislation.

In our last issue we referred to the proposed levy of a new tax, under the Estates Duty Bill, on South African mining shares. This had caused a depression in the market, and had evoked a protest from the London Chamber of Commerce. The tax was to be levied upon all bearer shares or bonds of dividend-paying companies either registered or doing business within the Union of South Africa, and on all non-bearer shares of companies, whether dividend paying or not, that are registered elsewhere. Payment is to be made by the companies, which are to recover the amount of the tax from the shareholders. Apart from the exaction itself, the sentimental effect at this time, just after a series of fiascos, was deemed most inopportune. It was regarded by those most interested as part of "a system of continual pin-pricks," a phrase used by Mr. F. J. Dormer at the Central Mining meeting. Since then the Union Minister of Finance has resigned. Although it is claimed that this resignation is due to differences regarding railway policy, it is believed that the opposition to the Bill was a contributory cause.

This new impost on the business incidental to mining is most unfortunate, for it comes at a time when public interest in South African shares is in danger of being withdrawn, after twenty years of keen participation. Apart from recognized causes it is a regrettable fact that an impression exists that the Union Government regards the mining industry as a convenient source of taxation and is indifferent to the feelings of European shareholders. The absence of any clear utterance from the Government benches of sympathy with the mining industry in its difficulties has fostered this impression, and the heavy charge placed on the industry by the Miners' Phthisis Bill has confirmed it. The impression may be wrong, but owing to the infrequent and fragmentary nature of the published reports of the debates in the Union Parliament, as given in European papers, we have no evidence to the contrary. Undoubtedly the tendency to hold aloof from South African enterprises does exist, and will develop unless counteracted by sympathetic action by the Union Government.

## Status of the Profession.

In 'The Shadow-Show,' that remarkable autobiographical book of Mr. J. H. Curle, we find one chapter that deals largely with the business of mining. Mr. Curle has seen so many aspects of the mining industry and he is—from the conventional point of view—so frank that we were bound to read this part of his book with peculiar interest. He deplores the fact that our "social universities practically bar the would-be mining engineer." Himself a Cambridge man, he speaks of his scientific training there as "the most fatuous mining

course on record." He points to the need of ability and character in the mining profession and regrets the social stratification in England that places the mining engineer below the army, navy, and reserve forces, not to mention the landed aristocracy, the church, the bar, and a few other sorts of people. He acknowledges that the "Americans lead the world in mining" despite the fact that the mineral resources of the United States are "not greater than those of the British Empire." Of course, they are not. Britain controls 70% of the world's gold output, for example, as Mr. Curle himself states. "But in America the mining engineer is high in the social scale; he ranks with the best; he is a college man, following up with a technical education, at one or other of the universities, that puts our technical system to shame." We have one School of Mines of which we are not ashamed, but even in appraising its particular service to the profession we may confess to partiality. However, it is the best in the British Empire. In the United States there are half a dozen, if not more, worthy to rank, if not to outrank, the best we can boast. This is humiliating. It is our own fault; we rate the human ore deposit according to its geological age instead of valuing it according to its yield of refined gold. Mr. Curle asks "what is the position of the mining engineer in English society." He proceeds to answer by stating that "to many people he figures as a superior mechanic; to others he is the superintendent of a coal-pit; to women, who are extraordinarily vague in these things, he is a stoker." To this we would add that to the man in the street or on the golf-links he is a semi-scientific person having some connection with queer doings on the Stock Exchange. This is said more in sorrow than in jest. We resent the fact and would gladly suggest a remedy. That is not easy. Yet something may be done. Mining engineers should cultivate solidarity and not be content to go through life as detached human units. Let them unite to promote an ethical standard, not in a sentimental fashion, but with both eyes on the fundamental fact that mining is a business that must pay dividends. Let them see to it that their sons get a good training, as good a training as their young friends in Canada or the United States. Above all let them keep a proud and persistent aloofness from all the financial trickery and fiscal legerdemain that brings mining down to the level of a third-class casino.

### Protection of Shareholders.

At the meeting of West African Mines, the Chairman, Lord Harris, made incidental reference to the publication of information that does not emanate officially from the directors or secretary of a company. He referred to the adverse opinion of the Jemaa lode formed by a competent engineer and published by *The Financial Times*. He protested against "the supposition that anyone may go on to anybody else's property, examine it, and give the information he gets to the public." He then went on to say: "That is not business; it is not etiquette, and it is not according to contract," and so forth. The distinguished chairman of the Consolidated Gold Fields of South Africa, and of other companies, exercises a wide and, in the main, useful influence upon mining affairs in the City of London; therefore such a dictum calls for comment. If anybody else had spoken thus we should have put it down to the bellowing of a bull that had been hugged by a bear, or, to put it in another way, to the annoyance of a director so tardy in giving information to shareholders that he had been anticipated by a more alert and more outspoken source of information. As this interpretation is not permissible, we must regard the incident as an official protest against the dissemination of any news concerning a mining property except through the secretary of the company, and by command of the board of directors. As a detached onlooker in this

difference of opinion between the editor and the chairman, we find no difficulty in giving our hearty support to the former. Obviously if the general body of mining shareholders is to be enjoined from obtaining information save by gracious permission of the directors, it will become increasingly unprofitable to take part in a game so one-sided. If directors would always remember that they are not privileged speculators but trustees for the real owners of the mines, that is, the entire body of shareholders; if information from the mine were always truthfully and promptly given; if directors took no advantage whatever of their early access to official news; then indeed there would be no need for other agencies to protect the shareholders by giving them the information denied to them officially. Unfortunately those in control of mines are often so dilatory, either by intention or carelessness, in making known the truth that outside operators find it profitable to engage their own engineer to ascertain the facts. In some instances the outside operator has been able to complete a profitable transaction, in buying for a rise or selling for a fall, before the ordinary shareholder has had an inkling that developments at the mine have been of a decisive character. No petulant protest against the telling of truth will suffice to obscure a condition of affairs that is perpetually placing the general public at a disadvantage. Lord Harris was unfortunate in giving us his notions of "etiquette' immediately after disclosing the fact that an important interim report, correcting a previous report of an absurdly optimistic character, had been received by his board of directors on April 25, only to be made known to the shareholders on May 20. It is a fact that the truth concerning the Jemaa lode was first made known by means of the publication of a telegram from a responsible engineer in the columns of *The Financial Times*. Subsequently, we published information obtained likewise from the operators for whom that engineer went to Nigeria. If Lord Harris and his friends had given trustworthy information promptly there would have been no need for anyone to intervene. Mining speculation is a game the success of which depends on priority of correct information. Unfortunately, directors do not always seem to realize that their first duty is to play the game in the interest of their backers, the shareholders. The public will elect to follow those that enable them to speculate profitably. As onlookers, we may smile at two opposing interests that pose as the sole purveyors of truth, and we deprecate a condition that lessens the investment and industrial feature of mining as against its speculative and gambling aspect. Meanwhile we ask both parties to remember that mining is the digging of metal out of the ground, and not the betting on shares issued under the Companies Act.

## Meticulous Estimates.

At the May meeting of the Institution the paper by Mr. F. Percy Rolfe, entitled 'Illogical Precision,' was the main topic of debate. In supporting Mr. Rolfe's contention, we revert to the subject under the title used in these pages last November. "Meticulous" means fussy or needlessly scrupulous about minute details. Mr. Rolfe made a good case and he will have no trouble in replying to those who undertook to defend a practice to which other adjectives beside "illogical" can be applied fitly. One instance, quoted by us previously, is that of an estimate of dredging ground belonging to the Natomas Consolidated of California. The yield and the cost were given to four places of decimals, namely, 9·9395 for the yield and 4·0889 for the cost, per cubic yard of gravel. Of course, no mining engineer alive can estimate the value of the gold to be extracted from a large tract of alluvium within 5%, that is, ½ cent in 10 cents per yard. Incidentally, we may mention that on the Natomas properties the fineness of the gold in the alluvium varies locally, so that the value of it,

from various drill-holes or shafts on the same tract, will differ by $1 per ounce. Here is a 5% factor of error, if the test be made by panning. Again, the sampling of placer ground by drilling is notoriously subject to error; the limit of error is fully 20%, and experienced engineers are accustomed to making a proper allowance. All this was fully known to the able engineer who gave his estimates with "illogical precision" to four places of decimals, but it may not be known to the shareholders and directors to whom his meticulous estimate was presented. In another case quoted, that of the Globe & Phœnix mine in Rhodesia, the estimate of the assay-value of the ore in reserve was given in pennyweights of gold per ton to three places of decimals. Thus, in June 1911 the estimate was 179,040 tons of 35·728 dwt. gold ore, and in June 1910 it was 174,788 tons of 32·259 dwt. ore. Now, it is apparent from the monthly development reports that less new ore was uncovered during the last year than was extracted, therefore the reserve should have declined, instead of being bigger. This points to a re-calculation of the tonnage and assay-value of the ore, a higher value being given to some blocks of ore remaining. To this no one can object, if it be, as we assume, in accord with later evidence. But it does point the finger of ridicule at a mere pretence of accuracy in using three places of decimals in giving the estimated number of pennyweights of gold per ton of ore. It also shows the futility of stating the tonnage to the last unit. Again, at the annual meeting of the company, the chairman confessed that he did not know whether his engineer's factor of safety was 10 or 25%. Even at 10%, that is, 3½ dwt. on 35 dwt., the three decimals must retire in blushing confusion.

At the Institution meeting it was claimed by one or two speakers that any doctoring of figures was dangerous, and, therefore, much to be deprecated. The idea was, that the figure resulting from a number of arithmetical calculations should be given faithfully without any attempt at modification. Anything else, so several speakers claimed, was insincere, and likely to encourage tampering with results. For this argument we have no patience. Either it overlooks the true facts of the case, or it is that manner of debate called "talking through your hat." As if every important item in a big estimate had not undergone modification; as if every estimate were not a final approximation based on precedent minor approximations; as i every engineer's estimate did not involve the use of a factor of error; as if mine valuation were an exact science. To take the estimates of a number of blocks of ore, whether quartz or gravel; to take a number of estimated details of cost any one of which is liable to an error; and then to give the final estimate in terms so precise as to suggest an impossible accuracy is no more scientific than it is to guess twice and divide by two with the expectation of doing something useful. Obviously *the numerical precision of a technical statement should be proportioned to the accuracy of the method employed.* If the method is necessarily inexact let us use round figures: if it be exact to a scientific degree, let us express ourselves in the precise terms of mathematics. Pretence is half-brother to untruth.

## Lonely Reef.

Proof of the non-persistence of rich ore in depth is unfortunately so frequent that it would be pleasant to chronicle the case of a mine giving indubitable signs of enrichment in depth. Such a case is supposed to be afforded by the Lonely Reef in Rhodesia. According to the speech of Mr. C. F. Rowsell, the chairman, the mine has "increased in values as depth has been attained." Indeed the increase is stated to be "quite regular." The official figures are quoted in Table I.

It is noted that the assay-value appears to increase with delightful persistence; also that the width of ore seems to become bigger

at each succeeding level. Nothing could be more pleasant. From the report for the preceding year we find the figures in Table II.

Thus in 1910 also the ore showed steady increase in richness. Yet the evidence does not harmonize. In 1910 the 15,788 tons above the third level averaged 27'6 dwt.; in 1910 the 7100 tons remaining averaged 20'32 dwt.; evidently the better ore was stoped, thereby decreasing the average and helping the theory of enrichment. The 15,788 tons at 27'6 dwt. between the 2nd and 3rd levels in 1910 was better than the 13,954 tons at 25'97 dwt. between the 3rd and 4th in 1911. Again, the 14,847 tons of 28'2 dwt. ore in 1910 between the 3rd and 4th levels compares with the 19,949 tons of 26'06 dwt. ore between the 4th and 5th levels in 1911.

TABLE I.

| | Tonnage based on width of vein | | | Tonnage calculated over stoping width of 12 inches | |
|---|---|---|---|---|---|
| | Tons | Width Inches | Assay-value Dwt. | Tons | Dwt. |
| Above 2nd level | 8,171 | 27'29 | 16'27 | 11,763 | 11'30 |
| Between 2nd and 3rd level | 7,100 | 28'70 | 20'32 | 10,068 | 14'33 |
| ,, 3rd and 4th ,, | 13,954 | 31'39 | 25'97 | 19,288 | 18'79 |
| ,, 4th and 5th ,, | 19,949 | 36'58 | 26'06 | 26,493 | 19'62 |
| ,, 5th and 6th ,, | 24,155 | 41'40 | 29'22 | 31,156 | 22'65 |
| ,, 6th and 7th ,, | 25,180 | 51'50 | 37'66 | 31,047 | 30'54 |
| Below 7th level | 8,544 | 51'71 | 42'73 | 10,526 | 34'68 |
| Totals and averages | 107,053 | 38'58 | 29'69 | 140,344 | 22'65 |

TABLE II.

| | Tonnage based on net width of reef | | | Tonnagecalculated over minimum of 36 inches | |
|---|---|---|---|---|---|
| | Tons | Dwt. | Total dwt. | Tons | Dwt. per ton |
| Above 2nd level | 12,750 | 13'5 | 173,144'1 | 17,079 | 10'1 |
| Between 2nd and 3rd levels | 15,788 | 27'6 | 437,134'5 | 20,284 | 21'5 |
| ,, 3rd and 4th ,, | 14,847 | 28'2 | 419,842'3 | 18,912 | 22'2 |
| ,, 4th and 5th ,, | 14,375 | 33'7 | 485,903'5 | 14,659 | 33'1 |
| Below 5th level | 6,420 | 36'8 | 238,279 | 6,500 | 36'5 |
| Totals and averages | 64,180 | 22'47 | 1,763,303'4 | 77,434 | 22'77 |

TABLE III.

| | Tons | Gold content Dwt. | Assay for stoping-width Dwt. |
|---|---|---|---|
| Above 2nd level | 12,750 | 13'5 | 10'1 |
| Between 2nd and 3rd level | 15,788 | 27'6 | 21'5 |
| ,, 3rd and 4th ,, | 14,847 | 28'2 | 22'2 |
| ,, 4th and 5th ,, | 19,949 | 26'06 | 19'62 |
| ,, 5th and 6th ,, | 24,155 | 29'22 | 22'65 |
| ,, 6th and 7th ,, | 25,180 | 37'66 | 30'54 |
| Below 7th level | 8,544 | 42'73 | 34'68 |

Some of the richer ore has been extracted; and that remaining, being poorer, tends to flatter the lower levels. Combining the evidence of the two reports we find that the correct inference is not that stated by the chairman. See Table III.

This proves that the increment has not the ideal regularity assumed; that is, once below the water-line, the ore has not exhibited enrichment until between the 6th and 7th levels. We shall be curious to compare the future record of the ground between the 7th and 8th levels with that now given, and based presumably upon the best portion of the orebody. The confident assertion of a "quite regular" increase in richness is not warranted. The average of the ore assured in 1910 was 22·77 dwt., while in 1911 it is 22·65 dwt., according to the two annual reports of the company. The estimated profit on 140,344 tons of 22·65 dwt. ore is £450,856. The ore contains gold valued at £635,758. Hence the total cost per ton is estimated at 26 shillings. The mill extraction has been 89%; it is expected that it will be 92%; we may assume 90%. On ore averaging 90·6 shillings per ton, the yield would be 81s. 6d. per ton. The working cost during 1911 was 28s. per ton; it is expected that it will be reduced when the mill is running regularly at full capacity. But the so-called 'cost' fails to include all the expenses of operating a mine in Rhodesia; no allowance is made for administration expenses, depreciation, royalty, taxes, all of which amounted to £21,795 in 1911, or nearly 20s. per ton milled. In addition, further development and more plant will inevitably be required from year to year. We shall be surprised if two years hence the total cost of operating the Lonely Reef mine is less than 35 shillings per ton, and, allowing for a 10% loss in extraction, it will be surprising if the realized profit is more than 45s. per ton, making the final profit payable in dividends, about £320,000. As against this there are 271,000 shares, now quoted at £3¼ per share, and therefore representing a valuation of £860,750. Of this only about 36% is apparently assured, so that the holder of Lonely Reef shares is risking 64% of his capital and all his interest. In order to return £860,750, plus 10% interest, in 10 years, the mine must yield in dividends not less than £1,600,000, which means that the orebody must continue as large and as rich to five times the present depth of the mine, or 4625 feet. We give this rough analysis of the position simply to indicate what a foolish game the shareholders are playing. The Lonely Reef is a nice mine and would be a reasonable speculation, but, of course, no investment, with 271,000 shares at 30 shillings per share. At that price the speculator would have 75% of his capital reasonably assured and would gamble the 25% remaining, together with interest on his capital, as against the chance of the mine developing favourably in depth.

## Gold for India.

For some years the large and increasing purchases of gold for India have attracted close attention at the financial centres, but during the last few months the question has ceased to be of restricted interest in the circles immediately concerned, the average man of affairs and those concerned with him in the production of the metal having begun to find it their duty to scrutinize the movement. Apart from the intricacies and technicalities of high finance, which only specialists are supposed to understand, the actual position and its development are comparatively simple, and form practically only an episode incidental to the change from a silver to a gold currency in our Indian Empire, the main difference between monetary conditions in India and in Western countries being the smaller proportion of the metal lodged by the native of India with credit institutions. We need not trace backward the history of gold and silver, respectively, as the standards of monetary value. Suffice it to say that after

a century and a half of a fairly steady natural ratio of value, the relative value of silver as compared with gold began to fall thirty years ago, owing to excess production. Many attempts were made by theorists and political economists to restore the ratio by recommending agreements between the nations, and in the United States the Government was induced to pass a law in 1890, now known as the Sherman Act, with the express purpose of creating a large public demand for silver, 4½ million ounces being bought per month and deposited in the Treasury against paper currency redeemable in silver or gold. This Act was repealed in 1893 and at once the price of silver suffered a further fall. Trade and banking relations became acute between India on a silver basis and England on a gold basis. Indian finance rendered imperative a change from silver to gold. Such a change, however, had to be effected gradually, and each step was taken cautiously. First of all the Indian mints were closed to the free coinage of silver, in 1893. This had the effect of still further depressing the price of the metal, but the exchange value of the rupee did not fall in the same proportion, and eventually it was steadied, in 1899, by making the sovereign legal tender in India at the rate of 15 rupees to 1 sovereign. The imports of gold into India began to increase in 1898, and after many fluctuations assumed commanding proportions in 1910. The figures for that year were £18,028,000 and for 1911 £23,366,000, and during the current year the imports average £3,500,000 to £4,000,000 monthly. Notwithstanding this increase of gold imported, the amount of silver purchased privately for India also increased rapidly, and finally with a view to discouraging the import of silver, the import duty was advanced to 4d. per ounce early in 1910. This policy has had the effect of lowering the import of silver and increasing that of gold. The latest proposition, now under consideration, is to commence a gold coinage for India, the denomination to be one of 10 rupees. Many authorities are opposed to the idea, fearing that it will still further encourage hoarding and so constitute a serious drain on the monetary requirements of Europe and other countries. The magnitude of this question may be gauged by the fact that the present absorption of gold by India is equal to the output of the Transvaal. As a matter of fact a substantial proportion of the weekly arrivals from South Africa finds its ultimate destination there. Much of the Australian production and even of its current coinage is being abstracted for the same purpose. The productions of other countries, such as North America and Russia, are not available to any great extent for English, French, and German requirements, so that the anxiety of European financiers with regard to the Indian demand for gold has unfortunately only too solid a basis.

### Anglo-Continental Mines.

To the regrettable episodes that have disfigured the records of the mining business must be added the Anglo-Continental fiasco. By the publication of Mr. J. F. Balfour's report, issued on June 5, this unpleasant affair is brought to a head. We are inclined to accept Mr. Balfour's appraisal of the Jemaa prospect, for it is couched in language that is sane and convincing. In brief, it amounts to this, that the lode is about 6 feet wide and averages about ½% tin, including occasional patches of ore containing 15%. Disconnected croppings have been traced for two miles. Float has been traced for a quarter of a mile, but no tin-bearing alluvium has been uncovered. Mr. Balfour concludes by saying: "Consider the property as a prospect only." This may be compared with the official circular of March 15, in which shareholders were informed that the lode had been traced for "over 8 miles" and that "for a mile and a half the average width is stated to be 30 ft. and the average value 20% tin." Again, on April 12, the manager, Mr. John

Thomson, and the superintendent, Mr. E. C. Powis, signed a cablegram asserting that there was a "splendid body of ore, very rich. Judging from surface indications the lode has every appearance of being permanent in depth." In consequence of these fairy tales the shares rose from £1½ to £8, relapsing slowly to £5, as the unreliability of the official reports become recognized by experienced men. On April 20, a cablegram from an independent expert, Mr. C. H. Wray, pricked the bubble, whereupon the shares dropped heavily, so that they were £2⅜ on May 20, when Mr. Balfour's interim report was published. Last November the quotation stood at par, that is, 10s. per share. At the time of writing they are quoted at £1. Thus the 300,000 shares that have been issued have oscillated in six months between 10s. and £8, representing a valuation ranging from £150,000 to £2,400,000. The difference of £2,250,000 indicates an enormous loss, mainly to the general public, which has been grossly misled. And on the top of the final exposure by Mr. Balfour, the board is so ill-advised as to quote the belated report of the Nigerian Inspector of Mines, who, on April 9, stated, in the language of an amateur, that "the lode itself appears to be a greisen capped by granite strongly impregnated with tourmaline, and having what appears to represent a foot-wall of micaceous schist very decomposed." He asserted that for over a mile he had seen a series of trenches exposing "very rich visible cassiterite." Cassiterite is usually rich in tin, even up to 78%, but we fear that some of the tourmaline was mistaken for tin by many of the so-called experts who have been giving optimistic opinions. And as if the farce was not already too long drawn out, we have Sir William Wallace, at a public meeting on May 23, quoting a correspondent who told him that "in his opinion, Jemaa will prove a veritable Johannesburg or Broken Hill; that the formation at Jemaa averages anything from 20 to 40 ft. and carries 20% tin at a very low estimate." It does seem to have averaged "anything" that anybody had a mind to say. But in the end it proves to be merely a hopeful prospect, for ½% tin ore is what a Cornishman would call a symptom of indications.

Our own information indicates that the deposit consists of a big outcrop of micaceous schist or schistose greisen, in which are scattered occasional patches or blebs of massive greisen, some of these being rich in cassiterite, while others are almost barren. At no time did the evidence warrant the confident assertion that a continuous lode of rich ore had been found. Whatever value the official information may have, it is rendered confusing by the absence of dates. The belated publication of reports is another sinister feature.

The Anglo-Continental company has a large concession on which sundry signs of tin have been found; it remains for all concerned to transfer their energies from Throgmorton Street to Northern Nigeria.

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### Labour Supply on the Rand.

It is generally recognized that the prosperity of the big mining industry in the Transvaal depends, to an extraordinary degree, upon an adequate supply of workmen. Despite the intensive effort to replace manual labour by machinery, it is a fact that human muscle remains the prime lever in extracting gold from the banket lodes of the Witwatersrand. Since the industry began to assume its present dimensions, every far-sighted mine manager has realized the importance of the labour problem. Stated briefly the problem is simply this: Will the supply of labour expand equally with the demand of the mines? If not, the industry must be crippled, and the big sums of money invested will, apart from the supply of ore, be unable to yield a profitable investment. To the mining economist the subject is vital. A plentiful supply of labour is essential to expanding industry everywhere. Machinery has not yet displaced muscle. One is required to

supplement the other. It was hoped, at Johannesburg and in London, that machine-drills would save labour in stoping, and it was imagined that rising wages would tempt the natives, once taught how to work, to remain on the mines. Unfortunately the machined drill-hole does not break ore as clean as the hole made by hand; and it has the further objection that more dust is made. Dust means disease, for it causes silicosis or phthisis. This has been ascertained by scientific investigation and recognized in recent legislation. As regards wages, the increase has not only failed to check, it has even tended to promote, the migratory habits of the native, who, as soon as he has accumulated a little money, departs for his kraal, to buy the wives that will cultivate the mealie patch necessary to simple living. In proportion to the cost of living no human being reaches affluence so quickly as the Kaffir willing to work for a few months underground.

| | July—December 1908 | July—December 1909 | July—December 1910 | July—December 1911 |
|---|---|---|---|---|
| Ore hoisted (tons) | 11,481,405 | 12,175,863 | 13,028,988 | 14,082,296 |
| Shaft sinking (feet) | 20,243 | 27,633 | 23,968 | 24,832 |
| Other development (feet) | 426,225 | 428,144 | 486,297 | 400,357 |
| Labourers at work: White | 18,065 | 21,306 | 23,959 | 24,026 |
| Coloured | 145,552 | 147,307 | 169,852 | 169,397 |
| Tons of ore hoisted per coloured labourer at work per six months | 79 | 82·7 | 76·7 | 83·1 |

In order to indicate the relation between the tonnage of ore and the quantity of labour expended, we append a comparative statement, giving salient statistics for the second half of each of the last four years.

As regards the number of native labourers "at work," it will be understood that this number is less than the total native labourers "employed," for the latter include those in the compounds, with idlers and sick.

It will be noted that the Rand figures are consistent, the tonnage per 1000 natives employed being fairly uniform, if it be remembered that the year 1910 was a period of heavy construction work, on the Randfontein, Brakpan, and City Deep, for instance. At the beginning of the current year 10,944 stamps had been erected and 9485 stamps were working. The average time in January was 27·35 days, crushing 8·02 tons per stamp per day. If the supply of ore were entirely sufficient the mills ought to be kept going on an average for 28½ days per stamp per month of 31 days. This would be equivalent, with the same duty, to 9102 stamps working 28½ days, as against the 9485 that do the work now. In order to keep all the mills fully employed in January an additional amount of ore should have been mined to supply 1842 stamps dropping for 28½ days with an average duty of 8·02 tons. This means that the tonnage should have been 20% more than it was. Undoubtedly some mines are suffering from the lack of a sufficient supply of profitable ore. It is also clear that an increase of 20% in the tonnage would not necessitate an equivalent increase in the labour supply, but against this it must be stated that the newest plants, such as the City Deep and Brakpan, have a duty of 14 to 15 tons per stamp. This calls for an accelerating supply of labour.

Sources of supply are various. In the accompanying tabulated statement it is shown that the Portuguese territory furnishes the largest number of the natives employed on the Rand, and that Cape Colony has become a

close second during the last two years. It is to be noted that the six years covered by these statistics include the period of Chinese repatriation and coincides with a time during which every nerve has been strained to augment the supply of labour. From January 1906 to March 1909 the number migrating from the Portuguese territory increased steadily from 68,000 to 92,000, a net increase of 24,000 in 3¼ years. Since then the supply has shown much greater fluctuation, and the net increase in 2¾ years has been 8000 only. During recent years recruiting has been extended to tropical regions and the quota therefrom has been increased by about 10,000. The yield from the southern Portuguese territory, that is, south of latitude 22°, has apparently reached its maximum, for the numbers registered at the end of 1909, 1910, and 1911, were 75,122—78,599—74,429 respectively. Meanwhile the high death-rate among the natives coming from the tropics has discouraged recruiting in that quarter; to which must be added a note that the Portuguese authorities give signs of being aware of their own need of natives for developing their own territory.

The natives from Cape Colony, having their home so much nearer than those from the East Coast, go to the Rand on shorter contracts. This explains the marked seasonal fluctuation, due to immigration between March and July. On the whole, however, a steady increase of supply is manifest, from 25,491 in January 1906, to 82,641 in April 1910. Since then the rate of increase has lessened, the figures for December 1910 and December 1911 being 75,280 and 73,911 respectively. The native of Cape Colony was not much in demand on the Rand until after the repatriation of the Chinese had been forced by the Transvaal Government, in 1907; after that event the Transvaal Government arranged with the Cape Government for improved facilities in recruiting. A rapid increase in the supply ensued up to April 1910. Now, however, this source of supply has been fairly exploited and any future increase will proceed at a diminishing ratio. This year the favourable factors are the bad harvest, the prohibition of recruiting for work in German South-West Africa, and the probability of a natural increase in a number that has been stationary for two years. On the other hand, there is the prohibition against the recruiting of natives under 18 years of age, and the diminishing attraction due to the novelty of work at the gold mines. Balancing these factors, it is likely that a small increase, mainly due to the bad harvest, will

AVERAGE REGISTRATION.

| Territory | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 Dec. |
|---|---|---|---|---|---|---|
| Portuguese | 65,512 | 76,255 | 87,579 | 91,157 | 95,625 | 97,435 |
| Cape Colony | 29,211 | 36,244 | 47,690 | 61,146 | 78,136 | 73,911 |
| Transvaal | 37,190 | 41,580 | 54,046 | 50,819 | 54,343 | 52,890 |
| Natal and Zululand | 17,929 | 22,572 | 23,059 | 28,545 | 34,155 | 39,860 |
| Basutoland | 9,283 | 9,838 | 9,518 | 9,247 | 10,092 | 11,689 |
| Orange River Colony | 5,193 | 5,233 | 5,648 | 5,492 | 5,871 | 6,796 |
| **OTHER SOURCES.** | | | | | | |
| British Bechuanaland | 2,479 | 2,354 | 2,776 | 2,839 | 2,885 | 2,592 |
| Southern Rhodesia | 3,219 | 1,921 | 2,463 | 1,823 | 1,866 | 2,028 |
| Swaziland | 2,245 | 2,740 | 3,830 | 3,014 | 4,101 | 5,296 |
| British Central Africa Protectorate | 2,264 | 1,092 | 775 | 1,318 | 4,101 | 2,263 |
| German S.W. Africa | 561 | 590 | 549 | 492 | 527 | 532 |
| N.E. Rhodesia and Fort Jameson | 603 | 302 | 246 | 173 | 135 | 108 |

be manifest, to the extent of about 10,000 natives. In the Transvaal itself a bad harvest in the northern area will cause a temporary increase, but it will not be more than a few thousand. In Natal and Queensland the supply is increasing slowly but steadily, and it is likely to be maintained, especially from Tongaland. From Basutoland and the Orange Free State no noteworthy increase is to be expected, while British Bechuanaland and Swaziland will help, also on account of a bad harvest; but such an increase will be small and temporary.

Summarizing the information available, it would appear that an increase in the labour supply was to have been expected in the early part of the current year; and it is a fact, as the latest statistics prove; but, being due to bad harvests, it is not of a permanent character. Hence at the close of 1912 the total supply is not likely to be notably larger than it was a year previous. This is disappointing. It might be supposed that an increase in the supply would result from the natural improvement in the native habits of work, but this favourable factor is negatived by the constantly enlarging demand for labour in other industries, notably agriculture. The farmer objects to seeing the natives led past his door by recruiting agents on their way to the mines, and that objection is stronger than ever. Fully one-half the natives on the Rand are recruited in foreign territory where local requirements for labour are increasing.

Thus the labour supply shows no signs of assured increase; but it must be recognized that a compensating factor will come into play by reason of the exhaustion of many of the important productive mines, such as the Ferreira, Robinson, Village Main Reef, and others known to have a brief life. This will gradually release a portion of the supply, for use in the younger mines, such as the City Deep, Brakpan, and Modderfontein. While insufficiency of labour will be felt in the winter season for a year or two, yet, with better methods of recruiting, less competition between the groups, and the increasing use of small machine-drills, as well as winches, it will be possible to remedy this vital defect in Rand economics. We conclude, therefore, that for the next two years the exploitation of gold mines in the Transvaal will suffer from recurrent periods of labour scarcity, but that after the two years the exhaustion of the older mines will afford gradual and permanent relief. The supply of labour gives no evidence of increase, but the demand exhibits signs of decrease. The mining industry of the Rand has nearly reached its zenith; with a cessation of expansion will come a cure for labour troubles.

## Central Mining.

The meeting of the Central Mining and Investment Corporation passed quietly. In the absence of Sir Julius Wernher, then ill and since, we regret to add, deceased, Mr. Friedrich Eckstein occupied the chair and explained the position. Like other financial organizations the Central Mining looks back on 1911 with no pleasure; it was a year of crumbling assets and infrequent opportunity for profitable business. It was suggested, from the chair, that depreciation has gone a little too far and that the extreme swing of the speculative pendulum was attributable "to the habit adopted by many chairmen in Johannesburg of indulging in prophecies which have not been fulfilled and, therefore, proved fatal." This little weakness is not confined to gentlemen of responsibility at Johannesburg, nor is it peculiar to the South African market. Moreover, it is a failing that is punished with tragic severity in times of depression. We shall not forget to quote Mr. Eckstein's remark in the days of the boom to which all of us look forward with exemplary patience. The chairman of the Central Mining, referring again to the disasters of 1911, said that "a lesson has been learned and taken to heart." Most of the big houses exhibit a

chastened mood, of which it may be said that the longer it lasts the better for the shareholders, particularly if it should be accompanied, as claimed by Mr. Eckstein, by additional precautions against the mismanagement of individual mines. In this regard the Central Mining Corporation has a big responsibility, for the mines under its control in 1911 yielded one-third of all the gold produced in South Africa, or 13% of the world's gold output, and the dividends paid by the companies of this group represented 52% of the total amount won in South Africa. It is satisfactory to note that Mr. Eckstein expressed confidence in the Rand as "a good field for investment," despite anxiety over labour and legislation. Naturally he is apt to take a hopeful view, having regard to the amount of capital locked up by himself and his friends in that mining region, but we welcome a little sane cheerfulness after so much depression and trust that it may be fully justified. We note that the Central Mining is seeking new opportunities in other regions, notably Canada, and we commend to it the vast field of mineral exploration still available in sub-arctic America. We refer elsewhere to the labour supply and the fiscal legislation in the Transvaal.

## Phantom Profits. II.

In our last issue we drew attention to the use of the word 'profit' as signifying not the final gain accruing from mining operations, but an intermediate stage of book-keeping, and the allied fallacy attaching to the term 'working cost,' as implying the expenditure incurred in winning dividends by the exploitation of mines. The later statistics for 1911 show that in that year the so-called profit made by the gold mines of the Transvaal was £11,414,863, but the dividends aggregated only £8,066,437, therefore the actual profit was only 70% of that claimed. We do not lay stress on this fact in order to depreciate Rand mining, but to emphasize the fundamental error arising from a mis-use of terms. In Rhodesia and in other mining regions the same blunder is made, but owing to the incompleteness of statistical information it is not possible to generalize as in the case of the Rand. Moreover, the bigness of the stake at issue warrants the pointing of a finger at the industry around Johannesburg. In order to bring the issue home we append further analyses of annual reports published by representative and reputable mining companies. Of course, the disreputable and irresponsible class of company cannot be subjected to such criticism; it is far beneath it. We are dealing with real business.

The El Oro Mining & Railway Co., one of the best administered of English enterprises, reports its "average working cost" as $5·42 per ton in 1909, $4·93 in 1910, and $3·90 in 1911. The average is $4·75. In the 1910 report the cost for the year is given as $5·17, but in making a comparison with 1911, in that year's report, the revised figure is $4·93. These figures include an average of 85 cents per annum for development and an average of 31 cents per annum for State and Federal taxes. During the three years the total output of the mine was 951,613 tons, yielding $7,394,429. Thus the average yield was $7·77 per ton. During the same period the balance of cash on hand diminished from £82,529 to £19,305, or £63,224. Six semi-annual dividends of £86,062. 10s. were paid, making £516,375. Thus the real profit was £453,151 or $1,206,845. This represents $1·27 per ton. Deducting this from the yield per ton ($7·77) we get the real cost, namely, $6·50 per ton. This is $1·75 or 28% more than the 'working cost.' The difference would be larger if a profit had not been made on the operation of the branch railway, which yielded £55,823 in the three years. Allowing for this, the profit made by the mine was only 98 cents per ton, making the discrepancy between the working profit and the real profit 42 per cent.

Under the heading of 'costs,' the Ouro Preto Gold Mines of Brazil gives "the total expenditure in Brazil" as 23s. 6¼d. in 1909, 24s. 3¾d. in 1910, and 24s. 8¼d. in 1911. The average is 24s. 2⅛d. per ton. During these three years the production was 218,458 tons, yielding gold valued at £308,526. 8s. 10d. The balance brought forward from 1908 was £3421. 15s. 11d., and the balance carried forward on June 30, 1911, was £5894. 6s. 2d. Thus there was an increase of £2472. 10s. 3d. The dividends paid during 1909, 1910, and 1911 amounted to £22,414. 3s. 11d. Thus the total profit was £24,886. 14s. 2d. This is equivalent to 2s. 3½d. per ton. The yield was 28s. 3d. per ton; therefore the total actual cost was close to 26s. per ton or 1s. 9⅝d. more than the operating cost in Brazil. Thus the discrepancy is only 7%. It is accountable to income tax, depreciation of plant and machinery, and a small loss in the Brazilian Dredging Syndicate. The depreciation amounts to about £4000 per annum, and there is no obvious reason why an average figure for this item should not be included in the accounts at the mine, thereby bringing the operating cost into even closer identity with the actualities of mining.

The Knights Deep gives 16s. 10·49d. as the 'working cost' for the year ending July 31, 1908, 14s. 5·363d. in 1909, and 12s. 3·149d. in 1910. The average for the entire period is 14s. 6·334d. per ton. During the three years the tonnage treated was 1,749,700, yielding £2,074,531. 4s. in gold, or 23s. 8d. per ton. The total dividends amounted to £611,349. 14s. In addition, a sum of £210,100 was appropriated for the redemption of debentures, so that the profit, not all to shareholders, but in part to them and in part to debenture-holders, was £821,449 14s. But the balance on hand at the end of the three years was £84,927. 1s. 7d. less than at the beginning, therefore the actual profit was £736,522. 12s. 5d. or at the rate of 8s. 5d. per ton. Deducting this figure from that representing the average yield, it is seen that the actual working cost averaged 15s. 3d. per ton or less than 9d. per ton more than the so-called working cost. The actual difference is only 5%. This is due to a fund for additions and renewals to machinery, plant, and buildings; to debenture interest; and to sundry small amounts appropriated for capital expenditure, and depreciation of stores. In addition, there is the Transvaal Government tax on profits, amounting to £73,607 or £24,402 per annum.

The Durban Roodepoort Deep is an example of a well managed Rand mining property. The working cost is given as 23s. 7·763d. for 1908, 22s. 9·117d. for 1909, and 24s. 7d. for 1910. The average for these three years is therefore 23s. 8d. per ton. The tonnage crushed during this period was 640,080 tons, yielding gold worth £974,652. 2s. 2d. Hence the average yield was 30s. 5d. per ton. The dividends distributed during the three years amounted to £121,000, from which must be deducted £52,386. 19s. 10d. which is the difference between the balance in hand at the beginning and the end of the three years. This leaves £68,613. 0s. 2d. as the actual profit, or 2s. 2d. per ton. Deducting this figure from the yield we find that the actual cost was 28s. 3d. per ton or 4s. 7d. per ton more than the 'working cost.' The discrepancy is equivalent to 19%. On turning to the annual reports it is found that £137,348, or an average of £44,347 per annum, went for capital expenditure, and £40,000 in two years for redemption of debentures. The Transvaal Government tax aggregated £12,698. 10s. or £4,232. 10s. per annum. On the other hand, the general expense of administration at the head office is included in the 'working cost,' so that in this respect a good example is shown.

In our next issue we purpose bringing the discussion of this important subject to a conclusion. Meanwhile we shall be glad to hear from our readers, especially the directors and engineers of mining companies.

# METAL MARKETS

## COPPER.

Average prices of cash standard copper:

| May 1912. | April 1912. | May 1911. |
|---|---|---|
| £72. 10s. 5d. | £70. 8s. 0d. | £54. 8s. 7d. |

Prices have rapidly advanced during the month and show an improvement of £6 in 'Standard.' The enormous consumption shows no sign of slackening; indeed it is being stimulated by cheap money. This is borne out by the increased deliveries from European warehouses, and heavy exports from America. The latter country which, from various causes, has been lagging behind, is gradually recovering her industrial activity and is also consuming more copper. Strikes are reported at the Baltimore and Balbach refineries, so that a lessened supply of refined copper will be felt at an inopportune time. Fine copper has practically disappeared from English warehouses, and consumers are dependent on shipments, while stocks at their own works are very low. Fortunately the public interest in the market is trifling, being discouraged by the depression on the Stock Exchange, so the bull account is small. It is too much to hope however that with the further advance in prices, which appears inevitable, the speculative public will be content to remain as spectators.

## TIN.

Average prices of cash standard tin:

| May 1912. | April 1912. | May 1911. |
|---|---|---|
| £209. 6s. 1d. | £200. 8s. 3d. | £197. 15s. 4d. |

The month opened with tin selling at £215 for May-June delivery. Dealing was excited, and both consumers and speculators bought largely. This price naturally brought out the East as a seller and good lines were disposed of to America. The price fluctuated and fell, under contradictory estimates of the shipments from the Straits, to £203, and later in the month when the London transport strike held up the available supply, it soared again to £215. 10s. The advent of the Banca sale however on the 30th once more induced bear manipulation, and prices broke sharply, so that an average of no more than £200 was realized at the auction. This low figure and the shipments from the East of 5750 tons, being close to the highest estimates, caused a further relapse. The position of the metal is quite sound and a rapid recovery is expected. American tinplate makers have been heavy buyers during the whole of the month. They are busy extending operations to compete with this country in her home market. The Banca production for 1911–12 is given as 1300 tons below that of the previous year, which may affect the sales of the Dutch government for 1913.

## SPELTER.

Average prices of ordinary brands:

| May 1912. | April 1912. | May 1911. |
|---|---|---|
| £25. 11s. 2d. | £25. 8s. 11d. | £24. 6s. 1d. |

Prices are steady with a good all round demand, and consumers are working at high pressure.

## LEAD.

Average prices of soft foreign lead:

| May 1912. | April 1912. | May 1911. |
|---|---|---|
| £16. 10s. 2d. | £16. 6s. 6d. | £12. 19s. 2d. |

Demand in this country is slow, but the Continent still continues to buy largely, and it seems impossible in spite of rising prices to satisfy their demands. Canada too has appeared as a buyer for substantial quantities, while Japan is increasing her consumption. On the other hand strikes in Spain and America, and the Mexican revolutionary outbreak are seriously interfering with supplies. The advance in price would have been greater had not the London strike induced speculators to sacrifice their holdings.

## SILVER.

The silver market has been remarkably quiet during the past month and little variation has been registered in the price 28d. per ounce standard. The large amount, 700,000 oz., recovered from the Oceana wreck coming on the market again had no effect on prices. Owing to the London dock strike, the sailings of the P. & O. boats to India have been interfered with, so that the figures for the export appear lower than they should be.

## OTHER METALS AND MINERALS.

Prices quoted on June 10:

SILVER.—28d. per oz.

PLATINUM.—185s. per oz.

BISMUTH.—7s. 6d. per lb.

ALUMINIUM.—£70 to £72 per ton.

NICKEL.—£170 per ton.

ANTIMONY.—£26 to £27 10s. per ton; ore (50%) £6 per ton.

QUICKSILVER.—£8. 5s. per flask.

MANGANESE ORE.—8½d. to 11d. per unit (one per cent.)

IRON ORE.—Cumberland hematite 26s. per ton at mine. Spanish 21s. 0d. delivered in England.

PIG IRON.—Cleveland 54s. 6d. per ton. Hematite 70s. per ton.

WOLFRAM ORE—29s. per unit (1%).

# PERSONAL

A. W. ALLEN is now in the service of Lewis & Marks, at Bulawayo.

R. T. BAYLISS has been visiting the Congo Territory.

W. K. BETTY is now living at Leatherhead.

JAMES P. BLANE has accepted an appointment with the Prestea Block A. company in West Africa.

ROBERT S. BOTSFORD has returned from Eastern Siberia.

CYRIL BRACKENBURY is in Greece.

F. T. BYRDE has returned from West Africa.

DONALD F. CAMPBELL is temporarily engaged in professional work for the U.S. Steel Corporation.

PERCY E. O. CARR, manager for the Mazapil Copper Co., is home from Mexico.

FRED G. CLAPP is examining oilfields in Alberta, Canada.

A. H. COLLBRAN is in London.

WILLIAM CROSLEY has gone to the Prestea.

J. H. CURLE is in Ecuador.

J. H. DARBY, of Brymbo, has been presented with the Bessemer medal of the Iron and Steel Institute.

T. LAUNCELOT DAWSON, manager for the Colombian Mining & Exploration Co., has returned from South America.

ARTHUR DICKINSON has left for Bulawayo.

FRANCIS DRAKE has been appointed consulting engineer to the Lonely Reef mine in Rhodesia.

D. L. H. FORBES has been appointed consulting engineer for the Trethewey mine, at Cobalt.

B. G. C. GARDNER has gone to Northern Nigeria.

F. LYNWOOD GARRISON is in Nevada.

H. W. GEPP is returning to Broken Hill.

ARTHUR GIFFORD, superintendent of the Mysore mine, is recovering from enteric.

W. H. HARDINGE is in London.

HENRY HAY has returned from the West Coast of Africa, and sails for New York early in June.

J. A. L. HENDERSON sailed on the *Empress of Ireland* for New Brunswick, Canada, and expects to be absent six weeks.

C. S. HERZIG has returned from Nigeria.

J. I. HOFFMANN is in Servia.

ROSS B. HOFFMANN is now resident manager for the Pioneer Company of Siberia.

BEN HOWE is in Western Australia.

J. P. HUTCHINS is in the Nerchinsk district examining alluvial ground for the Russian Government.

E. E. JOBLING has gone to Nigeria to take charge of the Western Orufu mines.

EDWIN B. KIMBALL is here from California, on a holiday.

H. H. KNOX is at the San Francisco del Oro mine, in Mexico.

C. D. LESLIE is about to take a holiday in Europe.

S. H. LORAM is expected in London from Valparaiso.

E. T. MCCARTHY is on his way to the Spassky mine.

E. D. MCDERMOTT has returned from Central America.

R. P. MCLAUGHLIN has opened an office in the Mills building, San Francisco.

WALTER G. PERKINS has gone to Atbasar, in Siberia, and will proceed thence to Korea.

H. A. PIPER is here from Rhodesia.

R. W. PRINGLE has opened an office at Gatooma, Rhodesia.

C. W. PURINGTON has been appointed consulting engineer for the Pioneer Company of Siberia.

A. BASIL REECE has been appointed assistant-manager on the Jemaa property of the Anglo-Continental Mines.

H. ROSS has succeeded P. Q. Treloar as manager of the Roodepoort United mine, at Johannesburg.

HERBERT KILBURN SCOTT has sailed for Newfoundland.

W. E. SIMPSON, recently in the Argentine, is returning to Mexico.

A. Y. SPEARMAN has returned from Mexico.

LESLIE A. E. SWINNEY is on his way home from Sumatra.

J. W. TEALE of Bainbridge Seymour & Co., has returned from Mexico and the United States.

H. A. TITCOMB has taken an office in Salisbury House, London.

J. B. TYRRELL has arranged with S. N. Graham to attend to his professional business during the former's absence from Toronto.

E. C. VIGEON has returned from a tour in Arizona and Montana.

J. C. VIVIAN left for North Queensland on June 5.

D'ARCY WEATHERBE has returned from Vladivostok.

ARTHUR R. WEIGALL is home from Korea.

S. J. WEIS is back from New York.

ERNEST R. WOAKES, on his return from South Africa, has gone to Spain.

# SPECIAL CORRESPONDENCE

News from our own Correspondents at the principal mining centres

## JOHANNESBURG.

**Accidents in Mines.**—This subject has been much discussed recently, but one important point seems to have been overlooked, that is, with reference to the actual number of accidents occurring to natives, who at the time of the accident are more or less intoxicated, in which state they often become either seriously injured or killed by falling down stopes or off ladders. Of all serious accidents underground, a large percentage are undoubtedly due to this cause. The quantity of illicit liquor consumed by natives on the Rand is at the root of many evils, not the least of which is the effect it has on the accident roll. In their rooms in the compounds the Kaffirs are continually drinking intoxicants before going to work; and on their way to the shafts they often show no signs of their being intoxicated, but the effect, for example, of walking down the ladder-ways and becoming hot in the warm damp atmosphere, is to make them obviously drunk, with the result that they get into the skip-way or fall off a ladder and thus become more or less seriously injured. It is accidents such as these that are unavoidable, no matter what precautions are taken by the underground staffs of the mines.

**Contractors' Natives.**—Something should be done to improve the conditions under which the natives in the employ of contractors—at surface—are allowed to live in special compounds under little or no supervision, with the result that they are able to obtain all the illicit liquor they require. With the native the most popular compounds are those in which the most liquor can be obtained: the reason for carelessness, on the part of contractors, in respect to the supervision of their compounds, is thus obvious. In order to obtain a good supply of voluntary native labour a compound must have the reputation, among the natives, for an abundant supply of illicit liquor. This is all that is necessary. The best compounds in this respect will be found to have a full complement of native labour. Generally speaking, in the mine compounds, as distinguished from the contractors' compounds, a more strict watch is kept. Thus natives in such compounds at

*SIMMER DEEP.*

the expiration of their contracts with the mine are apt to drift, as voluntary labour, into the employ of contractors, in whose compounds they are much more free to live as they like. For the benefit of the mining industry and the community generally, drastic changes are urgently needed to remedy the existing state of affairs with regard to the traffic in illicit liquor generally, and especially in regard to the supervision in this respect of natives in the employ of contractors.

**White Underground Employees** on the Rand are in danger of being adversely affected, if the ideas of some of the consulting engineers of the various groups are put into practice, to become hard and fast rules. The engineers are holding conferences and debating the question as to whether or not good men earning good pay do cheaper work than poor men earning poor pay. The discussion appears to have arisen over the 'day's pay plus bonus' system as compared with the flat contract system. As to which of these systems is conducive to the best work, there seems to be some doubt. There can, however, be little doubt as to the advisability of obtaining the best men and paying them well. If there are, however, any technical advisers of the groups who do doubt this point, they should first introduce a thorough system of recording in detail all data referring to underground costs and efficiency; from the figures obtained, and by experiment also, trustworthy evidence would be readily obtainable. Many consulting engineers and managers on the Rand have either never worked through the underground department at all or have done it so long ago that they have forgotten the difficulties besetting those who have at present to make the best out of the cosmopolitan mixture of men obtainable for work underground. It would, therefore, be in the best interests of all concerned if the opinions of those closest in touch with the underground employees were asked before any decided steps were taken in this or any other direction. At present this is the exception; it should be a general rule.

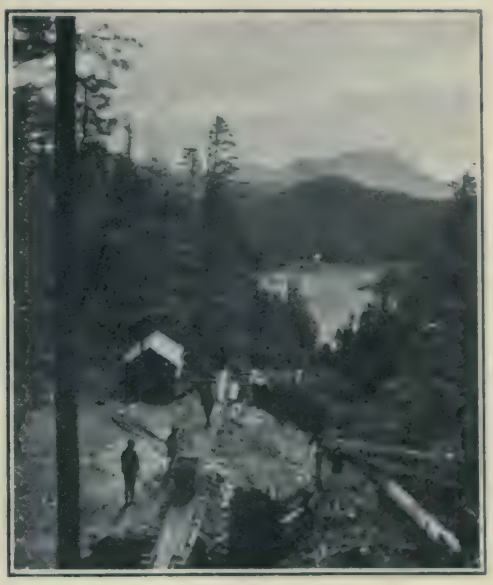
**Prevention of Dust** underground is at last receiving serious attention. In the early days of the Rand, miners dying of phthisis were said to be the victims of consumption. The cause of the complaint was not clearly understood. At present, if care be exercized silicosis may be avoided, but there still remains the possibility of tuberculosis being contracted. Preventive methods for allaying dust are now looked upon as imperative, and such methods, together with the increasing use of respirators, must necessarily have the effect of preventing sharp particles of quartz from entering the lungs of the workers. A more difficult and equally serious problem, however, is to prevent the possible infection of the lungs by the tuberculosis germs with which the mines underground are now infested, due to the fact that both white and native employees, already suffering from tuberculosis, expectorate in the underground workings, in such places as ladderways and skips. The damp humid atmosphere and the absence of sunlight all tend to increase the danger, and tuberculosis is being contracted in much the same way as ankylostomiasis in many collieries.

**Phthisis.**—The official report of the Phthisis Commission still remains unpublished, but from what is already known, the result of the inquiry into the question is having a decided effect. One important result is the impression it has already made on the minds of many men whose vocation it is to work underground, numbers of whom have already given up underground work, and there are many more on the verge of doing so. Men of the surveyor and sampler classes are already difficult to obtain. The result, therefore, of the phthisis scare is that many good men will be lost to the mining industry, whose places will have to be filled by less experienced men. Generally speaking, the best men are careful in every way, whether in regard to their work or health; the latter is the most important consideration to those engaged in underground work and if it is found that despite the greatest care, men still become affected by phthisis, then the mining industry will quickly lose many employees, capable of filling satisfactorily the most important positions on the mines. This important point deserves careful consideration by the leaders of the industry as, combined with the unfair treatment of good and capable men, which is only too common, the phthisis scare is rapidly driving away from the mines many of those who in the future would be best fitted to serve the mining industry.

[This problem is now before the Union Parliament. An effort is being made to induce the Government to see the fairness of accepting part of the financial burden to follow upon the proposed legislation, and not saddle so large a proportion of it—from £700,000 to £800,000 on the mining companies. It has been suggested, by Mr. Creswell, to include the blacks as well as the whites in the scheme of compensation. We refer elsewhere to this qnestion and to the additional fiscal tax on the mining business.—EDITOR.]

## SAN FRANCISCO.

**Iron production** on the west coast of the United States has been a source of much interest, since it is so closely interwoven with problems of economic development. The Pacific seaboard has always been chiefly a producer of raw materials, the manufacturing interests of the large cities that have grown up on the shores of the Pacific having been only secondary. This is a universal characteristic of countries where the density of population is small. The demand for a great variety of articles, none in great quantity, hampers the development of manufactures, especially nowadays when rapid transport is available to all parts of the world. Where the population is small, people naturally engage in the industries offering the greatest immediate returns, neglecting forms of endeavour that afford possibilities for the future, though little profit in the present. Unfortunately when lines of trade become established they are difficult to change when later development renders the starting of industry a source of profit. It is interesting to notice that of the 26,000,000 tons of pig iron produced in the United States in 1909 less than 400,000 tons, or 1·5%, was produced west of the Mississippi river. This small amount came chiefly from the plant at Pueblo Colorado, the Western Steel Corporation, of Seattle, Washington, not being a large producer. This company has had numerous vicissitudes and is at present undergoing reorganization, so that as yet the entire Western United States has been without a source of supply of iron and steel of local manufacture. This has hampered manufactures in general, since iron and steel and structural material cost much more than in the Eastern states; pig iron, for example, costing $27 per ton at San Francisco as compared with $16 at Chicago. These considerations led the Noble Electric Steel Co., some six years ago, to attempt to manufacture pig iron and steel from the magnetite ores of Shasta county, California, by electrical smelting. Much difficulty was encountered in the mechanical construction of the furnaces, but after a long period of experiment these have been successfully overcome and one furnace has recently been in continuous operation for over 20 days and has produced some 150 tons of pig iron in that period. The management claims that the operation of the furnace can be so well controlled as to produce either gray or white pig as desired, and that the product is of uniform quality. The ore is of much the same quality as Swedish magnetite, and charcoal is employed for the reducing agent. A by-product plant has been constructed and the manufacture of wood alcohol and wood pitch is successfully carried out. Statements of operating cost are not made public, but it is known that the company is able to secure electric power from the Northern California Power Co. at a slight advance over the cost of generation, which is about $10 per horsepower-year. Even at this rate it is a question whether the company will be able to supply pig of ordinary grade at a rate low enough to permit it to compete with the pig brought from a distance. As its name indicates, the first intention of the company was to engage in the manufacture of steel, but it has not yet attempted that particular problem.



*On Chichagoff Island, Alaska.*

**Disseminated** copper mines are much to the fore now, since the high price of metal gives them an opportunity to show what can be done with unrestricted production. It happens that reports for most of the big mines are available and they permit interesting comparisons to be made. While all show ore reserves that are enormous as compared with other forms of metal mining, there are certain striking differences. The Utah Copper Co. leads with a reserve of 301,500,000 tons containing 1·53% copper. The Nevada Consolidated, which estimates its reserve as averaging 1·66% in copper (and has operated for a month on ore containing 1·36%) has only about one eighth the tonnage, 40,083,371. Ray Consolidated, which ranks next to Utah Copper in reserve tonnage, has 77,314,470 tons of 2·17% ore, while Chino shows 54,970,646 tons

of 2·24% and the Miami 18,232,000 of 2·58% copper ore. Larger tonnage in these mines, therefore, does not necessarily mean lower grade, and while a higher price of metal permits re-calculation of ore reserves and transmutes waste rock to ore, the 'twilight zone' is wider in some cases than in others. A rule that has fewer exceptions is that increased mill-capacity is at the sacrifice of extraction, though even here metallurgical improvement has so far been sufficiently rapid to offset the expected loss. Repeatedly sections of mills built to handle 500 tons have proved capable of treating, with satisfactory results, 800 tons per day; and crowding the mill affords a means of quickly increasing output at all the mines. In times of low-priced metal the mills may be run on higher grade ore at moderate capacity and protected from undue wear. When metal rises the low-grade ore not profitable at other times can be crowded through, and increased tailing loss may be properly and lightly regarded, since in no other way could any of the material be made profitable.

**Miami.**—The first section of the mill of the Miami Copper Co. was started on March 15, 1911, and at the end of the year five sections, giving a daily capacity of 2500 tons, were in operation. In the present year the sixth section has been started and 3000 tons per day is now being milled. An interesting change in plans is the introduction of Hardinge tube-mills for fine grinding in the sections last added. In all 445,036 tons of ore containing 2·48% copper was treated, with an extraction of 73·37%. The cost at the mine is given by B. Britton Gottsberger as follows:

| | Per ton ore | Per lb. copper |
|---|---|---|
| Mining ..... | $1·2134 | $0·03500 |
| Milling ..... | 0·6274 | 0·01810 |
| General..... | 0·1706 | 0·00492 |
| Total ..... | $2·0114 | $0·05802 |

The total expense, including freight, smelting, and selling, amounts to 9·103 cents per pound of copper delivered at New York. J. Parke Channing, consulting engineer, thinks it probable that the extraction will be raised and the mining cost reduced as the work progresses. The ore milled this year included a relative high percentage of oxidized material and the mining cost was high because of the large amount of timber used in making the first cut around and over the orebody. When regular caving is started this expense will be eliminated. In the total cost there is an item of 31 c. per ton, which, on the basis of the known ore reserve, will liquidate the development and mine equipment, and provide for renewals. The reserve of ore is estimated at 18,232,000 tons containing 2·58% copper.

**Utah.**—The report of the Utah Copper Co., the pioneer among the so-called 'porphyries,' shows that 4,680,801 tons of ore averaging 1·51% copper was milled with a recovery of 69·53% copper. The cost of steam-shovel mining is given by D. C. Jackling as 33·73 c., of which 9·12 c. was charged to cover prospecting and shipping. Underground mining cost 68·35 c., of which 15·66 c. per ton was for development. The average cost of all mining was 44·79 c., of which 12·81 c. was for prospecting, development, and stripping; leaving a net cost of 31·98 c., including general and fixed charges. The milling cost was 41·68 c. per ton, and the total cost per pound of copper was 7·8655 c., as compared with 8·069 c. for 1910, after applying a correction of 1·07 c. per pound due to the gold and silver content. The new Bingham & Garfield railroad owned by the company began to haul freight on September 15. On it two train-crews handle 10,000 tons per day in less than 10 hours and it is expected that as a result the haulage will be materially reduced in 1912. The ore reserve is estimated by Mr. Jackling as follows: Fully developed, 92,130,000 tons containing 2% copper; 92,130,000 tons of 1·6%, and 75,660,000 tons of 1·30% ore; partly developed, 71,670,000 tons of 1·28%; making a grand total of 301,500,000 tons containing 1·53% copper. Reconstruction of the Arthur mill was continued through the year and it is expected that the last section will have been converted by the middle of 1912. The quarterly report of the same company for the period ended March 31 shows a total production of 24,929,550 lb. copper from 1,299,315 tons of an average copper content of 1·435%. The cost is given as 7·85 c. per lb. Severe winter weather interfered with operations and materially reduced the output.

**Nevada Consolidated.**—At Ely, as in other copper-producing districts, higher prices have permitted increased activity. Incidentally, according to the report of Pope Yeatman, consulting engineer, this company in June 1911 operated on ore containing but 1·36% copper; 294,793 tons being treated with a saving of 66·31%. The total tonnage treated during the fifteen months covered by the report was 3,338,242 tons assaying 1·80% copper, 0·013 oz. gold, and 0·079 oz. silver. The percentage of copper extraction was 67·59; of gold, 57·72; of silver, 45·92. Mining cost has averaged 15·7 c. per dry ton, to which is to be added 15 c. to cover stripping redemption on the Eureka

orebody and 22 c. on the Liberty. Great reduction in milling costs were effected through increasing the amount sent through each section of the mill, and in the reverberatories the furnace capacity per day has been increased from 223·5 to 359 tons in consequence of oil-firing. At the same time the cost has gone down 63 c. per ton of charge, equivalent to 24·31%. The average cost per pound of copper is given as 7·7 c. Adding miscellaneous earnings but deducting for improvements and depreciation, the final cost at New York is 6·97 cents. The ore reserve is estimated by Mr. Yeatman at 40,853,371 tons containing 1·662% copper.

**The Ray Consolidated and Chino** reports are also available but as neither company

per section or 9000 tons per day for the eight completed sections of the mill. The net cost for the year was 10·34 c. per pound of copper. On the basis of delivery to the new smelter, now being built at Hayden, this cost would have been 9·33 and on the same grade of ore the present actual cost is given at 9 cents per pound.

Chino operations are also satisfactory. The mill will soon have a capacity of 5000 tons per day. The total reserve is estimated at 54,970,646 tons containing 2·24% copper. Of this, it is estimated that 66% can be mined by steam-shovel. The average grade that can be so mined is slightly lower than the general average of the ore, being 2·21%. The cost of steam-shovelling for the year was 31·68 c. per

*STEPTOE VALLEY AND SMELTER, McGILL, NEVADA.*

was a large producer in 1911 they are principally interesting for their estimates of ore reserves, saving, and costs. At the Ray, D. C. Jackling estimates the fully and partly developed ore at 77,314,470 tons averaging 2·17% copper. Of this 64,700,000 tons with 2·16% copper is considered fully developed, having been defined in blocks 200 ft. square by churn-drilling. The cost of mining for the year was 81·6 c. per ton but for the last quarter was only 76c. or nearly the original estimate of 75 c. The output at the end of 1911 was 3600 tons per day. It was then expected that this would be increased to 5000 tons by the middle of 1912. During February 1912, the extraction was 70·35% on ore averaging 1·68% copper and treatment was at the rate of 1100 tons

yard, equivalent to 15 c. per ton. In January 1912, the cost was 8 c. per pound of copper.

**The North Star Mines** company owns and operates at Grass Valley, California, the most important lode mine in the State, and its report of operations for the year ended December 31, 1911, just issued, is received with corresponding interest. The year was a profitable one, the gross production being $1,025,087, and the net operating profit $468,681. During the year 98,400 tons of ore was produced, from which 3000 tons of waste was sorted out and 95,400 tons, of an average gold content of $10·75, was milled. This is lower than in 1910, when the ore averaged $13·68 per ton, the decrease being due to more systematic working of the stopes, instead of endeavour-

ing to extract only the best ore. The operating expense was $5·83 per ton, a decrease of $0·27 as compared with 1910, although more careful sorting out of waste is being carried on. Development work in the North Star mine during the year consisted of 3973 ft. of driving and rising, at a cost per ton of $0·487 or $0·07 less than during 1910. This development work consisted of extensions of the present workings between the 3000 and 5300-ft. levels, with generally favourable results, and some ore of fair grade was opened on the 5300-ft. level, which is the deepest in the mine, so that the outlook for the persistence of the orebodies in depth continues encouraging. The exploration work at the Cincinnati Hill mine, 3120 ft., was disappointing, nothing of value being discovered, and this work will soon be abandoned unless results are obtained. Early in the year the company secured an option on the Champion mines, six miles east of Grass Valley, which was afterwards extended until July 1913. The services of Messrs. Ernest Howe and F. L. Sizer were secured for its examination, and the shafts have been repaired and re-timbered, levels cleaned out and re-timbered and new pumps installed, and the opening of undeveloped ground is now in progress. The cost of this, including an instalment of $30,000 on the purchase price was $154,701. The geologic structure and the history of the district warranted the belief that the veins persist in depth and this extension of the work of the North Star is of great general interest.

Of the total production of the year 77·1% was recovered by amalgamation and 22·9% by cyanidation. Of concentrate 1978 tons was produced which, after grinding in a tube-mill, yielded $71,561 by cyanidation. The average assay of the cyanide tailing was $0·24, indicating an extraction of 98% of the gold content. The operating expense per ton milled at the North Star mine is divided as follows: Mining, $3·317; milling, $0·526; concentrating, $0·138; cyaniding, $0·541; bullion, $0·031; miscellaneous, $0·311; general expense, New York office, $0·163; taxes, $0·282; accident and benefit, $0·064; a total of $5·373, sundry receipts producing a net cost of $5·345. The dividends paid during the year, No. 27 to 30, amounted to $425,000, or at the rate of 17%. Since 1884 this property has produced 933,357 tons of an average content of $13 93 per ton, and has paid dividends amounting to $3,486,989. This splendid enterprise was organized by the late James D. Hague and for many years has been managed by Mr. Arthur De W. Foote.

## TORONTO.

**Porcupine.**—The Dome mill is still only partly in operation, owing to continued difficulties with the water supply, and for some time not more than 20 stamps have been working. The total shipments of gold to date amount to 268 lb. Shipments will be made fortnightly. Mining operations are mainly confined to the first level, and the pinnacle of quartz from which the property takes its name has nearly disappeared. Development work is being pushed at 200 ft. The large orebody at the 100-ft. level from shaft No. 4 at the Dome Extension is now known to be over 100 ft. wide. A drift is being run to cut the series of veins coming in from the Dome property and is now in 325 ft. The West Dome is handicapped by scarcity of fuel and has laid off part of its working force and discontinued the night-shifts. Coal will have to be shipped in at great expense if operations are to be continued. Delays in the shipment of machinery and Custom House red tape are responsible for the further postponement of the date of opening the Hollinger mill. As soon as the tubes and the cyanide plant are ready the mill will be started without waiting for the large crushers, using a small crusher now on hand for the dump-rock. Underground work is being steadily prosecuted, some 4500 ft. of driving and cross-cutting having been effected. The gold content is reported to increase in depth. The Vipond has also been inconvenienced by delays in delivery, but it is expected that the mill will be in operation early in June. There are 6000 tons of ore on the dump that will run over $8 per ton. Stoping on the Godfrey and Davidson veins has begun and cross-cutting is being done at the 300-ft. level. At the Hughes the main vein has been cut at the 100-ft. level, where it is 30 ft. wide, and gives an average gold assay of $12 per ton, with further gold-bearing country-rock for 5 ft. on each side. A power-plant and compressor are to be installed. The McIntyre has cut a vein of solid quartz 27 ft. wide at the 200-ft. level under the west end of Pearl lake; this is supposed to be the Hollinger lode. An 8-ft. vein has also been encountered on the 200-ft. level to the north of No. 4 shaft. Work has been slackened lately owing to lack of air-power. At the recent annual meeting of the Rea shareholders an entirely new board of directors, with two exceptions, was chosen. A number of shareholders who recently visited the mine are strongly in favour of continuing operations, and if the necessary funds cannot be obtained by a loan on a new issue of stock, the mine

will probably be leased. The McEaneny, owned by the Crown Reserve, has its shaft down below the 200-ft. level, and is blocking out ore at the 100 and 200 ft. levels. A carload of 30 tons has been shipped for treatment with a view to ascertaining what kind of mill will be most suitable to the character of the ore. The consignment of 4700 lb. ore sent by the Dome Lake to the Kingston School of Mines to be tested having yielded satisfactory results, a 10-stamp mill, to be operated with tube-grinders, will be installed. A sufficient body of ore to run the mill for a year has been blocked out on the 100-ft. level, where the main lode is 4 ft. wide. A new compressor plant is being installed. The Crown Chartered has made its last payment on the Davidson property, from which good ore is being taken out at the 100-ft. level. The Pearl Lake has passed under the control of a syndicate of New York and Philadelphia capitalists, who will undertake development work, having paid off debts of the company amounting to about $100,000. R. W. Stevenson will be in charge. At the Three Nations a number of small stringers carrying coarse gold have been found on the 100-ft. level. The Achilles property has been purchased by the Cobalt Star Mining Co. The Jowsey claims, covering 260 acres in northern Deloro, have been sold to the Gold Peak Mining Co.

**Cobalt.**—The advance in the price of silver has had the effect of reviving interest in several properties on which operations had been discontinued. Active work has been resumed on the Ophir, John Black, Silver Queen, Ruby Silver, Cobalt Contract, and other prospects, but so far this movement has had little effect on the stock exchange where shares are little in demand and prices remain low. At the Green-Meehan, now the property of the W. S. M. K. Co., the vein that was cut at the 200-ft. level some time ago has been proved for 125 ft. and has widened from a mere stringer to 9½ in. of high-grade ore. The April report of the Nipissing shows a production of $225,145, of which $200,000 was in bullion. The most noteworthy development was at shaft No. 122 where 60 ft. below the surface the drift is in 6 in. of high-grade ore assaying about 5000 oz. At the Meyer shaft, which produced silver valued at $184,271 during the month, work on the third level shows places in the vein where there will be 10 to 12 ft. of mill-ore. On the big Nipissing hill prospecting is being carried on by the hydraulic process, with a pump throwing 4800 gal. water per minute, washing away the overburden and leaving the rock bare. The head offices of the La Rose Consolidated are being removed from New York to Montreal as the first step to making it a Canadian corporation, to save the expense of transacting corporate business in New York. The Beaver mill is working satisfactorily and treating 60 tons of ore daily. The first carload of 33 tons of concentrate netted $20,000. Ore is being raised to the mill from four levels. The Trethewey has made a disbursement of profits amounting to 10%. The Cobalt Townsite is producing somewhat over 30,000 oz. silver per week. Seventy-five tons of low-grade ore from this mine are treated daily at the Northern Customs mill. Two new high-grade veins have been cut in diamond drilling.

*THE DOME MINE, with new mill, now at work, in the distance.*

**New Goldfields.**—The Kienawisik Lake, or as it is sometimes called the Hurricana district, in Quebec, is attracting many prospectors from Porcupine and Northern Ontario. Kienawisik Lake lies about 45 miles southeast of the town of Hurricana, a point on the Grand Trunk Pacific Railway some 140 miles east of Cochrane. Several free-gold discoveries have been reported and considerable areas have been pegged. Many well-known Porcupine mining men have acquired interests in the district. The latest accounts, however, are not favourable. Another region to which gold hunters are turning their attention is Turnbull, about 15 miles southwest of Porcupine. As yet no definite information as to the actual value of either of these goldfields is obtainable.

## CAMBORNE.

**Droskyn & Wheal Ramoth.**—A syndicate called the Droskyn Syndicate, Limited, is being formed with a capital of £7000 to acquire these ancient shallow mines situated at Perranporth, and to carry out the preliminary work advocated by James Roberts, who is the prime mover in the scheme. The management has been placed in the hands of John Taylor & Sons, and their re-entry into Cornish mining is a noteworthy event. It is to be hoped that their experience this time will be more fortunate than their last venture in East Cornwall, namely, Drakewalls. They are starting on rational lines, and, before erecting expensive mining and ore-reduction plant, propose to test the property by clearing and unwatering the Droskyn engine-shaft and then extending the 40-fm. level on the main lode in both directions, and proving the backs so laid open by means of rises. If this preliminary work gives satisfactory results, a company is to be formed with a nominal capital of £118,000, of which £60,000 will be working capital. It is satisfactory to note that the grantee of the sett is content to transfer the license for an undertaking to allot him 8000 fully paid shares in the larger company when formed, so that the whole of the capital of the syndicate is available for testing purposes. This is a pleasing contrast to the case I referred to in my notes last month, where £137,500 was paid in shares for several water-logged mines with no plant on them whatever.

**Basset Mines.**—The accounts for 1911 show a profit of £9508, of which £2237 was allocated to depreciation, £882 to wipe out the adverse balance standing at the commencement of that year to profit and loss account, £6050 in payment of a 7½% dividend on both classes of preference shares, while £338 is carried forward. The company has a reserve of close on £21,000 invested. The following figures show clearly the year's work as compared with the two previous years:

| | 1911 | 1910 | 1909 |
|---|---|---|---|
| Tons milled | 43,286 | 40,541 | 42,587 |
| Black tin sold, tons | 586½ | 699 | 484 |
| Produce per ton (mine-stuff only) lb. | 32·05 | 41·5 | 44·4 |
| Average price realized for black tin | £121. 8s. 3d. | £93. 11s. 6d. | £75. 10s. 0d. |
| Total receipts | £71,220 | £65,435 | £63,754 |
| Receipts per ton of ore milled | 32s. 11d. | 32s. 3d. | 29s. 10d. |
| Working cost per ton on mine-stuff | 31s. | 31s. 6d. | 29s. 9d. |

The following is an analysis of the working cost on mine-stuff:

| | s. | d. |
|---|---|---|
| Pumping | 6 | 3·1 |
| Development | 6 | 5·5 |
| Winding | 6 | 8·6 |
| Dressing | 5 | 2·1 |
| Repairs and maintenance | 4 | 6·2 |
| Establishment and general charges, lord's dues | 1 | 11·2 |
| | 31 | 0·7 |

The development amounted to 6474 feet, or roughly one foot for every 6¼ tons of mine-stuff milled. This ratio is, considering the width of the lodes, a good deal more than was necessary to keep pace with stoping, and goes to show how vigorously the property is being explored. In this connection, it is regrettable that such slow progress is being made in sinking Pascoe's shaft, which a month ago had only reached a depth of 8 fathoms below the 310-fm. level. The lode in the shaft has averaged over 60 lb. per ton for this 8 fathoms of sinking, and is the best point in the mine. It looks, from the developments at the 310-fm. level, as though a richer zone of ground has now been reached, and certainly the patience and faith of the management and shareholders deserves a handsome reward. The manager reported that the pumps for several months raised over three million gallons of water per 24 hours.

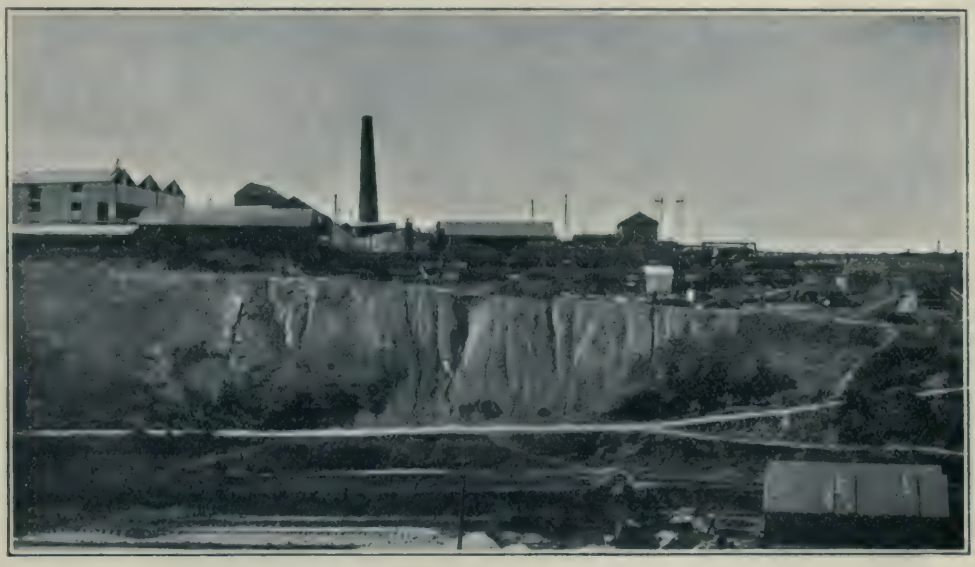
**Falmouth Consolidated.**—It is gratifying to hear that operations at these mines are now again in full swing, and that a further attempt is being made to drain the mine below adit. A recent circular issued by the company states that from July 1911 to April 29 last, 104 tons of black tin was sold, realizing £10,781, but as the tonnage milled is omitted, it is impossible to get at the recovery. The company is now selling its concentrate at the Ticketing instead of privately, and the first two sales amounted to 21 tons, realizing £2627, or an average price of £125. Forty Californian stamps are now at work, and on the basis of 800 tons milled per week, or 3200 tons for the four weeks referred to, the recovery works

out at 14·7 lb. per ton handled. The report above mentioned quotes the manager as stating that with 60 stamps at work, as expected shortly, a monthly working profit of £1500 can be expected with a recovery of 20 lb. black tin per ton of ore crushed, reckoning on 4800 tons per month, and black tin at £112, and that every one pound recovered in excess of 20 lb. per ton will give an additional profit of £240 per month. It is clear, therefore, that he anticipates a 15 lb. recovery will meet the working cost. If this forecast is fulfilled, and proportionate development cost is included, it will be a lesson to the county in cheap handling of stuff, even although all work is above adit. It is to be hoped that, when the ground below adit is available, the recovery will improve. Two Humboldt furnaces, for roasting the concentrate, are in continuous operation, with, it is reported, excellent results. This is the only installation of this class of furnace in the county.

Since writing the above, the official figures for the 4 weeks ended May 24 are available, and they show little difference from my forecast. The tons crushed were 3061, black tin sold 21 tons 6 cwt., value £2666, and recovery 15 lb. per ton. The workings below adit are now unwatered to the 60-fm level.

**Bosparva.**—This virgin property at Gwinear, situated within half a mile of the Parbola sett, is being prospected with good results. A shaft was sunk 60 ft., at which depth an excellent lode was intersected, and now the property has been acquired by the Gwinear Mines Syndicate, Ltd., a company having a capital of £3000 and controlled by the same group as is working the Carn Brea sand heaps, with Arthur Richards at their head.

**Cornwall Tailings.**—The accounts for the year ending February 29, 1912, show a profit earned of £11,264, from which dividends amounting to 5s. per share have been declared, equalling 25% for the year, leaving a balance of £2641 to be carried forward. The reserve fund set aside for depreciation now stands at £5000. The tonnage treated was 62,578 wet tons, including the re-treatment of 6643 tons of by-products; thus the weight of tailing handled from the dump was 55,935 wet tons, equal to 47,535 dry tons, assaying 20·9 lb. of metallic tin per ton (as compared with 19 lb. for the previous year), and containing a total of 442 tons of metallic tin. From this was recovered 277 tons of black tin, containing 170 tons of metallic tin, the gross value of which was £31,380, which, less smelters charges £3534, and cost of purchase, treatment, etc., £12,658, left a working profit of £15,188, from which head-office charges, depreciation, etc., £3924, must be deducted to arrive at the net profit of £11,264, stated above. In view of the paper on the Cornish Tin Ticketing in the last issue, it would be interesting to know how many tons of concentrate was covered by the smelters charges of £3534. The recovery of 170 tons of metallic tin equals an extraction of 38·5% of the tin con-



*WORKS OF THE CORNWALL TAILINGS COMPANY.*

tained in the tailing as shown by chemical analysis. The interesting statement that 13 lb. of black tin per ton was extracted, whereas by vanning, the assay of the tailing only showed 10 lb. per ton, makes it clear that, on a large scale, a more complete extraction of slime tin is possible than by the vanning assay method. The gross value of tin extracted per ton of wet tailing was 11s. 2½d., less smelting costs 1s. 3d., leaving 9s. 11½d. per ton. The costs of purchase, treatment, etc., including the re-treatment of by-products, amounted to 4s. 6d. per ton, leaving a profit of 5s. 5½d. per ton. The new pipe-line, through which it is proposed to pump the tailing by aid of water, will shortly be at work, and this change from carting the stuff, it is anticipated, will save 5d. per ton. It is estimated by Arthur Richards that there still remain 1,100,000 tons of tailing for treatment. Ross K. Macartney, for several years chief engineer at Mount Bischoff, has recently been appointed general manager of the works.

**West of England Tin Corporation.**—This private company has recently been registered to acquire and deal in mining claims in the West of England, and generally to act as an exploration company. The capital is £50,000, all of which will be available to carry on operations. The directorate includes John Gilbert and Horton Bolitho, both of Carn Brea & Tincroft Mines, and the Hon. A. V. Agar Robartes, while E. S. King is associated with the company. It is noteworthy to find that Lord Clifden, through his son, is actively interesting himself in the revival of the county's chief industry, and it is to be hoped that some of the other large landowners will follow his excellent example. Such a company as this can do much to direct attention to the mineral resources of Cornwall, and controlled as it is by practical men, I anticipate for it a successful future. The first proposition to which the company's attention will be turned is the treatment of the tailing-dumps of the once famous Great Devon Consols arsenic mine near Tavistock.

**Mine Prosecutions.** — During the past few months there have been several prosecutions at the instance of the Inspector of Mines for offences under the Metalliferous Mines Regulation Act and the Quarries Act, and it is evident that the new Inspector will permit no slackness on the part of the mine owners in carrying out the provisions of these Acts. Wheal Hampton was fined for failing to make the necessary return of the quantity and value of minerals sold during 1911, while similar treatment was meted out to the Meledor Clay Works for failing to return the number of persons employed last year. Recently, too, the late manager of the Falmouth Consolidated Mines was fined for various breaches of the Act, so it behoves owners and managers to carefully observe the regulations laid down.

While on the subject of regulations, it is of interest to note that a jury in bringing in a verdict of accidental death in the case of a man recently killed at the Levant mine, added a rider to the effect that steps should be taken to see that every employee be made fully acquainted with the mining regulations, for it was felt that many accidents in Cornwall were due either to ignorance of these regulations, or the carelessness of the miner in observing them. A good suggestion was made by one of the witnesses before last year's Royal Commission dealing with this subject, to the effect that the regulations should be read to the men periodically, and that a list of 'Don'ts' should be published by the Home Office, and a copy handed to each employee.

**Carn Brea & Tincroft.**—The reward of vigorous development in a good district is clearly shown by recent discoveries made on this property, and the lesson should not be lost sight of by those other mines in the County which are content practically to mark time in this respect. The 320-fm. cross-cut has intersected Duncan's lode at 97 fm. from Martin's East shaft. The full width is not yet known but for the first eight feet it assays 30 lb. of black tin per ton. It is interesting to note that it was estimated by the late management that this cross-cut would reach the lode at a distance of 65 fm., but at the shareholders' meeting in February last, when already 80 fm. had been driven, Mr. King, who had re-surveyed the position, said he thought 100 fm. would be nearer the mark, and so it proves to be the case. A good deal of criticism locally has been levelled at Mr. King on this point, but he must now be glad that he stuck to his guns. The other discovery is the North lode at the 160-fm. level from Highburrow East shaft, which, at the point of intersection, was 3½ ft. wide and assayed 90 lb. of black tin to the ton. This lode however has always been patchy where worked in other parts of the property, so it will be safer to await further development before working much of it. Ten rock-drills are now in operation at Carn Brea & Tincroft solely on development work. For the first five months of the year, 34,328 tons of ore has been treated, producing, according to the ticketing sales, 411 tons of black tin, or 27 lb. per ton. The con-

centrate has realized £47,281, or an average price of £115 per ton. It is quite evident that the current six months will show record figures all round, and the gross profit should exceed that shown in the best half-year so far in the company's history, when an amount of £10,162 was earned. In spite of the greater development, the normal working cost has not increased, although of course the advance in the price of coal owing to the coal strike had an adverse effect, for 1½ million gallons of water is being pumped each 24 hours by the five pumping engines. Experiments have recently been made by Mr. King with a revolving buddle which by means of scythe-shaped knives automatically removes the three products, concentrate, middling and tailing, and so does away with the heavy labour involved by the shovelling on the buddle, a point to which visiting engineers to Cornwall have so often directed attention. I hope to give further details in my next letter of this buddle, which Mr. King claims is doing excellent work.

**Basset & Grylls.**—This little property at Wendron has been acquired by Oliver Wethered, and the management placed in the hands of E. S. King, of Carn Brea & Tincroft. The mine was shut-down early in 1911 owing to lack of capital. The Main or Old Men's Shaft was then 35 fathoms deep, and it is now proposed, I understand, to sink the shaft a further 25 fm. and cross-cut about 30 fm. to intersect the Wheal Cock and other lodes. The lodes are rather patchy and small, so before starting the mill again, it is important that a good deal of development on the lodes should be carried out in order to ensure sufficient working faces to keep up the tonnage and grade. In the last working, 3800 tons of ore was crushed for a yield of 41½ tons of black tin, or 24·5 lb. per ton. There is an excellent battery and dressing plant on the property.

## MELBOURNE.

**Labour.**—It is astonishing how the labour issue dominates every industry in Australia at the present time. References have been made to this matter in previous communications, but it looks now as if some of the predictions, that the Labour party would have a fall, are really to be verified. In Queensland electors have followed the example of South Australia, and in Victoria a vote would certainly mean a reverse to the Labour party. The whole community has been suffering from a dose of excessive prosperity and the consequence has been that with the Labour party in power the workers have become most aggressive. This phase of the question has led to a great deal of unsettlement in the mining industry. Mr. Richard Hamilton, the president of the Chamber of Mines of Western Australia, in a recent address took the opportunity of admonishing the miners' Unions of the trouble they have caused, and warning them of the dangers that are ahead. In that State, as at Broken Hill in New South Wales, the miners receive a wage that is the envy of every other worker in Australasia. Yet, Mr. Hamilton points out that the increasing tendency of the worker is to ignore the means provided by legislation for the settlement of industrial disputes. This is the experience also in New Zealand, where, as in West Australia and in Victoria, demands are formulated, and then when the Wages Board or the Arbitration Court gives an award the men, if not satisfied, immediately resort to a strike. The Unions know as well as is possible that no Government can send to prison or fine hundreds of men who may elect to defy the arbitration legislation. They, therefore, contemptuously ignore the means provided by Parliament for the settlement of their disputes. On the other hand, no such attitude can be adopted by a company or an employer, because in their individual capacity they can be seized or mulcted without difficulty by the authority that has the right to enforce the law. The difficulty at Kalgoorlie is, as pointed out by Mr. Hamilton, that "if a proportionate rise in wages, based on the demand of the highest paid workers, was obtained by all the men working on the mines, it would immediately render unprofitable the operations of a third of the mines connected with the Chamber, and throw some thousands of men out of work, who would be forced to seek employment in other industries which pay a lower rate of wages. The attitude of some of the workers is such that if they tried to devise means to wipe out the industry of mining, they could not adopt a more effective plan." The result of such a state of things is exactly as is predicted by Mr. Hamilton, that for a short time the men working the richer mines would obtain higher wages but the bulk of the men would lose their employment. The real cause of the trouble is the lack of knowledge of economic laws by the leaders of the Labour camp, or their deliberate blindness to the operation of such laws. The State of Victoria, under Mr. M'Bride as Minister of Mines, elected to start coal mining at Wonthaggi, in the Powlett basin. This State enterprise has been watched by observers everywhere, but

like most undertakings under Government control, it has drifted into a perilous condition. The miners, first of all, by clever agitation secured the payment to them of wages far in excess of the average at private collieries and at the gold mines in the same State. The result was a drift of labour to the State mine and consequent competition for places. As soon as this was found out the unionists schemed to maintain a wage that would protect the employees from the effects of competition among the workers themselves. After a while the management of the mine passed from the hands of the Mines Department into those of the State Railway Commissioners. These gentlemen, under authority from Parliament, handle not only the railways but the State coal mine on business lines and without political interference. It was not long before their severer regime brought them into conflict with the miners, who insisted, first of all, on the abolition of the 'dog watch.' Then the general manager notified that he was paying 3s. per ton as the hewing rate for continuous working with three shifts, and that as only two shifts were to be worked in the future the hewing rate would have to come down to 2s. 9d. The opportunity was taken to clean-up several disputed points, in favour of the good management of the venture. A list of men to be dismissed was posted. The miners were amazed at the strength of the power behind the general manager as contrasted with the ineffective control under the political head of the Mines Department. Their protest was in the form of a strike. The community here, therefore, has learned first of all that State employment is costly. Secondly, that discipline under the State is most difficult to maintain because of the political power of the Unions. Thirdly, that the employees, though under allegiance to the State as public servants, would not have hesitated to throw the whole transport service of the country out of gear, simply to ensure their claim to a wage to which they were not entitled. It is understood that the Railway Commissioners have determined to stand beside the General Manager. If they do so, then labour will find itself in conflict with the State. Some very important issues may then arise, because the Federal Arbitration Court may try to coerce the State Railway Department. If it does, the Ministry may be stiff-necked and there may be a direct conflict between the Commonwealth and the State governments.

**Broken Hill.**—In the main matters at this centre are in the most happy condition. Investors here and in London however must have received a great shock when they heard of the writing down of the ore reserve in the Block No. 10 mine, from 500,000 tons to 282,000 tons, with a consequent readjustment against the company and its financial position. The Block 10 claim, originally a portion of the Proprietary company's property, was famous for its kaolin ore. Now, however, at depth the average of the sulphides has dropped to under 13% lead and 13·1% zinc. This means that the mine besides having its life shortened will be able to work up a profit only when the price of metals is high. A large number of the company's shares are held in London and on the continent where the real weakness of the company's position will have to be made known. The only chances of a recovery is that what is termed the eastern orebody may be found to contain more ore than it has been credited with; also that the new formation cut on the boundary of the Block 10 and Central leases may extend into the Block 10 ground and so give it additional supplies.

**Oil Flotation.**—Mr. T. W. Wellsted, one of the partners of Bewick, Moreing & Co., has arrived in Victoria after having visited Kalgoorlie. His appearance here follows that of Mr. T. J. Hoover of the Zinc Corporation. Speaking of the latter, word has come that his reports on the operations of the Zinc Corporation are satisfactory as to the future of the enterprise. It is a great pity that this company, with the knowledge that its officers have obtained and the technical skill it has at its command, does not look after some of the other complex mineral deposits in Australia. In Queensland there should be an opening in several localities and everyone knows that for a generation past the huge ore deposits of Rosebery, in Tasmania, have been awaiting a suitable process. The suggestion has been made that an adaptation of the Oker process should be used in connection with the smelting works at Zeehan. Then the bisulphite process is to be tested at the Tasmanian Copper Mines, and once upon a time it was proposed that the Horwood process should be utilized in connection with the Minerals Separation process, on the Hercules ore. Whether one or other or all of the processes are to be given a run at the different properties is not disclosed, but there has been such a buying and firming of shares in the market as to suggest to observers that something is in the wind.

**Copper.**—The development of the copper region in Northern Queensland is being car-

ried on satisfactorily, partly by reason of State aid and partly because of private enterprise. The State is fast linking the different copper mining centres one with another. While this is being done companies are using their capital to build smelters and carry out genuine development work. So far, the chief fear in respect of mining in this part of Australia is the uncertainty whether ore-shoots would be picked up at depth. At Mt. Elliott for instance the No. 5 level seemed to be barren of ore above 2% grade, but not long since the diamond-drill went through rich ore at a little distance from the shaft. An important discovery at this level meant a change in the appraisal of the property, so a cross-cut was started promptly. It went into rich ore, but it was found that this ore reached only 2 ft. above the cross-cut. Boring proved that the ore went underfoot, but the hope that it extended down from the shaft has not been realized so far. The impression at the moment is that the find is far less extensive than it was at first pronounced to be. The Hampden company has had to complete two tasks in order to start smelting on the £1,000,000 of ore reported as proved in the company's Duchess and Hampden claims. The first was the big smelter at the Hampden and the second the construction of the 45 miles of railway to connect the two properties. The latter work should be finished in June and the smelter should be ready in May. There are not a few people who are afraid that the smelter will not get into full swing without preliminary difficulties. Why they should assume this in view of the fact that the Duchess ore makes an admirable flux for the Hampden ore is hard to say. But the doubt exists. At the same time it should be stated that the board intends to meet any trouble in this direction by employing the best qualified copper metallurgist it can find.

**The Great Cobar** mine in New South Wales has been responsible for squeezing a good many pence out of the pockets of the bears on this side of the world. Some of them acted on the belief that the ore reserves were too low-grade to give profits. Others took the view that the new separation plant would not help to make the company financially strong. Still others doubt if the gold ore from the Great Cobar mine would sweeten up the mine output to the extent expected. The people at the mine now avow that they have everything in such trim that a dividend is in sight. It seems too soon to predict this result on the work done with the new plant, but it is certain that if the general manager, Mr. H. C. Bellinger, can by hard work and the expenditure of capital get the accounts on the right side of the ledger he won't fail for want of effort. One of the difficulties that may be ahead of him may be the large quantity of silicious ore he has to handle.

*BLOCK 10 MINE, with Mill in distance.*

# DISCUSSION

Our readers are invited to criticise anything appearing in this magazine and to discuss other subjects of general technical interest.

## Cornish Tin Ticketing.

The Editor:

Sir—Mr. Harold E. Fern's article in the May number of your magazine is an excellent and painstaking contribution on this subject.

The author is of the opinion that the returning charge which I gave for Cornish tin ore, in your March number (page 202), namely, £9 to £11 per ton, is considerably below actual facts. A little reflection on the part of Mr. Fern would have probably recalled to him the fact that the returning charge must vary with the price of tin.

The loss in smelting tin ore is not a fixed one, as it depends upon the skill of the smelter and the purity of the ore, and as such is an important factor, apart from the actual cost of smelting. What the actual smelting loss is, it is difficult to ascertain, as the slag, 'hard-heads,' and various other intermediate products which are the results of tin smelting, have to be treated over and over again, in order to come to finality. If, however, we assume that the loss in smelting ultimately amounts to from 2% to 4%—and perhaps some of your readers may give some more definite figures on this point—it is obvious that for every variation of £10 in the price of metallic tin, on the basis of 3% loss, this is equal to 6 shillings per ton.

When I wrote my short note on the sale of tin ores, the figures which I took were not based upon the present prevailing high price of tin, but rather the average price over 10 years, which may be put at from £130 to £140 per ton of white metal.

In glancing over Mr. Fern's table, on page 354 of your magazine, it will be seen, excepting an obvious error which has occurred in the first column for the July price (£118. 15s.), that his value of the white metal is taken at about £185 to £190 per ton. If we therefore take my basis of the white metal at say £130 per ton, against £185 to £190, we find a difference of about 36s. returning charge per ton, and as Mr. Fern's average works out at £13. 8s., my maximum price of £11 per ton was not far off the mark.

It is curious to observe in Mr. Fern's computation of returning charges, that on one occasion, namely, July 24, 1911, when white metal stood at £186 per ton, his returning charge came to £16, and just below this column, when tin stood at £189. 10s. per ton, the returning charge was £11. 19s. per ton.

It is therefore obvious that the returning charge, apart from the actual slag-losses, cost of smelting, and smelter's profit, to a considerable extent depends upon the position of the tin market and stocks of tin ore the smelters are carrying. On the whole, however, as mentioned before, Mr. Fern's paper is one which can be recommended to the careful study of those interested in the mining and marketing of tin ores, as it has been worked out on scientific and commercial lines, and not in the 'rule of thumb' fashion, which, unfortunately, has been too often the case in the West of England.

O. J. STEINHART.

London, May 30.

[The July price on page 354 should have been £188. 15s. instead of £118. 15s. as printed.—EDITOR.]

## Words and their Uses.

The Editor:

Sir—The champion of precision in the use of words is continually confronted with the argument that when a certain word used in a certain way conveys an idea clearly to those acquainted with the subject there is no need to disturb the established practice. If this argument is to be adopted, the transmission of knowledge by the written word will meet its Armageddon or its Waterloo. Provided all the members of a profession had equal knowledge of all the ramifications of a complicated congeries of intimately connected subjects, or if they met together for personal intercourse regularly and often, the use of cryptic terms understood only among the freemasonry of the craft might be allowed. But what is to be said of the chances of the engineer expatriated in the wilds of the Bolivian plateau or of the Never Never Land, when he wishes by means of the written word to pursue his studies in some particular subject of which he has had hitherto nothing but an elementary knowledge?

You often say that definite references to offenders high in the ranks of technology afford better opportunity for drawing attention to this laxity of language than mere platitudes and generalities. I therefore take the liberty of quoting our friend Mr. W. F. Grace, who has done such excellent mining work at the Waihi Grand Junction in New Zealand. In his report for 1911 he says: "The average value of the tailings or residues for the year has averaged 4s. 6d. as against 4s. 8d. in 1910." In the first place there is the unnecessary plural; second, a work of supererogation in the

use of both words 'tailings' and 'residues'; third, a duplication of idea is found in the words "the average . . . . . has averaged." But the greatest offence is in the statement that the 'tailings or residues' have a 'value' of 4s. 6d. per ton, when the 'value' is nothing at all, seeing that the material is all thrown away.

Another case of confusion of terms is found in an excellent article by Mr. E. M. Hamilton in the *Engineering & Mining Journal* for April 27. This article contains a discussion with regard to the conditions determining the practice to be adopted for treating gold and silver ores, in which part of the precious metals is found in pyrite or other sulphides; whether it is preferable according to circumstances to remove the sulphides by concentration, cyanide them separately, grind and return them to the slime, sell them to the smelter, or not to concentrate at all but treat the ore in one operation. All through the article the word 'concentrate' is used to denote the 'sulphides.' This interchange of words is permissible after the sulphides have been removed from the rest of the ore, but when the author refers to treating the 'concentrate' without removing it from the ore, then he commits a breach of correct nomenclature and introduces an illogical and confusing method of thought. How can a thing be a concentrate if there has been no process of concentration? The learner will surely be befogged, when reading the paper, unless he has an expert at his elbow to answer the conundrum: When is a concentrate not a concentrate?

EDWARD WALKER.

London, May 29.

## Gold with Copper Ores.

The Editor:

Sir—Your February issue states that the variation in gold content of the Kyshtim pyritic ores is due to the variation in the amount of chalcopyrite present. As the actual facts are, I believe, somewhat unusual, I venture to correct your statement.

The gold content of the pyrite itself is quite constant and independent of the percentage of copper where present as chalcopyrite. At one mine there is a quantity of pyrite containing less than ½% copper, but 2 to 3 dwt. in gold, which is the average gold content of smelting ore from this mine. On the other hand great variation in gold occurs associated with the presence of the mineral tennantite. Samples of this mineral carefully separated from the ore assayed as high as 16 oz. gold and 50 oz. silver per ton.

In the same mine another type of ore appears, a white silicious schist with a very slight impregnation of tennantite, but almost no pyrite or chalcopyrite. This ore, containing 2% copper, has twice or three times the average gold content of the pyritic ore.

C. T. BRODRICK.

Kyshtim, May 1, 1912.

[While thanking our correspondent for the additional interesting details, we would state that he has misquoted us when he makes us say that "the variation in the gold content of the Kyshtim pyritic ores is due to the variation in the amount of chalcopyrite present." What we said was that the "gold content in the ore which is massive pyrite is fairly regular, and the variation of gold *per ton of copper* is due to the greater degree of variation of the amount of chalcopyrite in the pyrite." We have italicized the words so as to make the point clear.—EDITOR].

## The Finance of a Mine.

The Editor:

Sir—In your last issue I replied to most of my critics and there remain only Mr. W. H. Goodchild's, Mr. Morton Webber's, and Mr. C. S. Herzig's letters that require comment.

As the space allowed by your Magazine is limited, I am unable to answer Mr. Goodchild as fully as could be wished, bearing in mind his paper on 'Annuity Calculations' some years ago in the transactions of the Institution of Mining and Metallurgy. In spite of the fact that the discussion of his paper showed a general acceptance of the idea that an extra rate of interest should be asked of those undertakings thought to involve greater risk, Mr. Goodchild now traverses the validity of this demand. He joins the ranks of those who advocate the 'inspiration' valuation methods on the ground that hope of profit, not estimate of risk, should be the dominating idea when valuing speculative investments. Evidently we should not consider the number of failures recorded on the share market or elsewhere, but only keep in view the glorious hope of gain. But how are we going to moderate our hopes? We all hope from an investment, most assuredly; but dare we state that we temper our hopes by calculation, consciously or unconsciously, of the risk of failure? This may be based on general personal experience or upon special data. By his doctrine of geological inspiration, Mr. Goodchild places himself on record as stating that one is just as much entitled to allow a shoot-extension of 1000 ft. as another who cedes but 100 ft. Or, again, one

is just as much entitled to allow full value for a block of ore 1000 by 1000 as another 100 by 50 ft.; or the first may insist that one sample from a block is sufficient instead of the 100 sample-sections demanded by the second man. Let us find courage enough to admit that the inspiration or hope-of-profit theory as a basis for investment is conveniently productive of appreciation at the hands of predatory promotion; but the valuing engineer who is employed to use his knowledge on behalf of investing clients will, in estimating reserves, employ something higher than the Consol rate. Why? Hope might give them any value. This would evidently be Mr. Goodchild's dictum. By all means let us admit that we hope for profit but that we count the chances of failure, and that the sane man is governed by the latter in his selection of investment or in weighting a block of ore.

Let Mr. Goodchild persuade you to give him space for a paper on the fundamentals of speculation rather than make a loose statement claiming that the late Mr. Hoskold's theory is unsound. Unsound it may be, but only when we agree on a basic premise as to soundness, which according to me involves the consideration of a series of investments or the insurance concept; the latter was evidently the underlying idea of Mr. Hoskold, and not the academic postulates advocated by Mr. Goodchild in his paper. If your Magazine will find space for such a paper and adequate discussions, we should be able to come to some conclusion regarding 'geological inspiration,' and to lay to rest that irritating bogey 'allowance for risk,' so ruthlessly belaboured by Mr. Goodchild's actuarial cudgels.

Mr. Herzig's choice of cases to justify his preference for 'inspiration' methods might have been happier. In citing the practice of the Exploration Company, most of us will agree that its engineers enjoy an exceptional name for integrity and ability, but it is necessary to distinguish between the recommendation of these gentlemen when advising and determining the terms of purchase of a property and its subsequent flotational policy pursued by the purely financial interests. Before taking up the case of the Tierra Buena, if Mr. Herzig will turn to my Article III, he will find that the whole capital of the Alaska Mexican and Alaska United properties call for only 21 and 20 ft., respectively, below the deepest level; and yet with such short dimensions and values few would question the moderation of the allowance. In reality according to the theory set out in my articles this shoot-extension could probably be claimed as reserves. From this it will be seen that the value of the reserves more than covers the whole of the capital issue.

This example shows how necessary it is to approximate the magnitude of the economic shoot before criticizing a flotation, and yet Mr. Herzig diligently sets up the shoot-extension allowance of 32% of the capital of the Tierra Buena company as sound. He can only reconcile the practice of the same company at different times by showing that the magnitude of the Tierra Buena shoot, or its equivalent, justified the allowance. If Mr. Herzig will turn to the account of the above flotation published in this Magazine, he will find that the Exploration Company expended £168,000 on the property but extended this over a year and a half, developing or having developed in that time ore to the value of £225,000. The amount of preliminary payment made for the property, if any, was not disclosed, but one gathers that it was small and suspects from the wording that the original arrangement was a working option with the payment of purchase price after the development of additional ore. If this is a correct version of the transactions we have another example of what I have contended: that experienced engineers seldom advise a single cash payment at one time in excess of the value of the positive ore, and that while the ultimate price paid for a property may exceed this largely, sound practice will determine the terms of payment in such a manner as to convert possible into positive ore before further cash is paid.

I venture to call Mr. Herzig's attention to *The Mining Magazine* of January last which deals with the purchase of the Tomboy mine, for this sheds a most luminous light on the practical significance of terms of payment. As further examples of the practice of the Exploration Company it is also of particular interest. In the Tomboy flotation the returns stood for £150,000 and the possibilities at £150,000, of which only £70,000 was recovered from the former. The shoot appeared to have a length of 2700 ft. but its economic dimensions are not given. The Exploration Company seems to have profited by this lesson, for in the next purchase of the Argentine claims by the local engineer the terms were so arranged as to delay payment pending development, with the result that before the purchase price of £13,000 fell due some £24,000 of profit was actually made. Again in the case of the purchase of the Revenue property

by the same company, the purchase price of £80,000 was covered by £122,000 of reserves, taking these at 138,000 tons having a profit of $4·50 per ton. Unfortunately the magnitude of the economic shoot in neither of these cases is given, but by the light of fragmentary published accounts the practice of the engineers of the Exploration Company as distinct from the directorate, would seem to be along the very lines advocated by me in the articles: that the terms of payment should be regarded as an integral part of valuation.

In the face of the above cases and many others known to every experienced engineer, it would be interesting to know the basis of Mr. Morton Webber's extraordinary statement that "when mines change ownership the price is invariably considerably in excess of the net value of the ore reserves." It is just such impossible generalizations which tend to deter engineers from a careful survey of conditions and to postpone the time when economic principles become the first course in the curricula of our mining schools and the arbiter of sound practice in valuation.

M. H. BURNHAM.

London, May 20.

[This discussion is now closed. It has served its purpose in directing attention to one or two points hitherto insufficiently recognized. Kindred subjects are open for discussion in these pages, and we shall be glad to publish contributions from mining engineers and directors. —EDITOR.]

## Gold and Silver in Sumatra.

The Editor:

Sir—Mr. Truscott's paper on 'Gold and Silver in Sumatra' gives an interesting account of the history of gold mining in that island, its geology and ore occurrences, which leaves one with a desire for more. We may perhaps later be favoured with some detailed description of the actual working of the mines, means of transport, reduction processes, power used, if wood fuel, its condition and efficiency, timber for buildings and how it is protected from white ants, and so forth.

With regard to the paper, these ore occurrences are again an illustration of the intimate genetic relation of orebodies with intrusive igneous magmas, in this case andesite. In regard to the rhyolite, this, I presume, has been definitely identified by microscopic examination. Otherwise, seeing that silicified andesite may resemble dacite, which is only to be distinguished from rhyolite by the character of its felspar under the microscope, it might be possible that the so-called rhyolite is really andesite, which had received an addition of quartz by silicification proceeding from the vein. The silicification of one wall of a quartz lode in preference to the other is not without precedent.

Presuming the identity of the rhyolite to have been definitely established, it would be interesting to know whether it preceded or followed the andesite, being probably a differentiation product from the same magma. Finally, through fissures in the hardened crust, from the still liquid interior at depth came the magmatic emanations, which solidified from aqueous solution to form the present ore deposits. At what depth these emanations changed from pneumatolytic to aqueous, their degree of concentration and the part played by the ground-water circulation, will here, as elsewhere, afford scope for much speculation. In reference to these questions the presence of selenides and cinnabar may be noted, indicating hot magmatic vapours or waters as the carrying agent.

With regard to the manganiferous ore of the Mangani mine, I would suggest that the statement, on page 363, "From this it would appear that the silver content occurs enriched in the oxidized portion, while the gold remains unchanged," may not state the case correctly. In view of W. H. Emmons' paper on 'Manganese and Gold Enrichment,'* it might be more correct to say that some of the gold had been leached out of the oxidized portion, leaving the silver behind, and thus increasing in it the proportion of silver to gold.

At the bottom of page 363 the author says: "It now remains to describe the occurrence of gold and silver ore in connection with the alteration of limestone," but no contact-metamorphic deposits are described, only veins in the diabase intrusions. Are these meant, or are there other deposits in the altered limestone?

By the way, referring to the last paragraph, the limestone hills in the district I visited, just south of Achin, were every bit as densely wooded as the rest of the land.

W. F. A. THOMAE.

## The Main Question.

The Editor:

Sir—Mr. H. C. Hoover points out in your May issue that in the instance of £880,000 (out of a nominal capital of £1,000,000) being transferred from the pockets of "idiots" to

* Bulletin No. 46 A. I. M. E., Oct. 1910.

company promoters, no economic loss occurs —from a national standpoint.

As dependents of an industry the local capital registrations of which have rapidly fallen to 18% of what they reached 17 years ago, we should consider the actual effects such transferences have on the industry, which necessarily has to compete against other classes of security in the attraction of capital.

Such an instance as Mr. Hoover mentions, means that the "outsiders" who purchased the scrip on the assumed favourable speculative value of £1 (that is, at face value) were buying tickets in a lottery the owners of which retained a commission of 88%, over and above the reasonable allowance he makes for them of £15,000. If the remaining 12% is welched (by flotation of unwarranted prospects) in 50% of the cases and maladministered in a further 25% of them, these "outsiders" would be getting on an average 7·2 pence worth of "reasonable venture" for their 20s. It is not surprising—even if the instance be considerably above the average, and mining be highly profitable on the necessary capital—that the sanity of the public is so definitely established by the withdrawal of their financial support. Most of what little money we now get we owe to the fact that some people will gamble in scrip whether there is a prospect of its having any ultimate value or not. I consider the small total amount of working capital obtained in recent years disproves Mr. Hoover's assertion that "experience shows that it is a minor quantity" of the proceeds of free scrip obtained by promoters that does not return to the industry.

We should no longer shirk the obvious fact that the future progress of the industry necessitates giving the public an attractive gamble (if not investment) when subscribing the capital of *new* ventures with the intention of holding such scrip permanently. Moreover we must admit that the exorbitant commission retained and the amount of welching have been ample cause to make the industry "stink in the nostrils of the public." That the latter include the honourable members of an honourable profession in such odium is no more surprising than that the average board of directors is unsatisfactory to shareholders.

The following axioms should be realized:

(1) That the public have ample other channels for investment and are naturally quite indifferent as to whether the mining industry goes entirely to the dogs or not.

(2) It is of vital importance to the profession that new mining issues, as a whole, shall form an attractive means of speculation (if not investment) for the uninitiated public.

I was pleased to note Mr. M. H. Burnham's opinion expressed in the same Magazine that mining would show "surprisingly favourable" results on the necessary capital, and also that the industry can be elevated to an investment basis.

Last year's Somerset House registrations (£18,400,000) may mean that the equivalent of less than £1,500,000 will be reasonably well applied as working capital. If investment and speculation in new industrial undertakings is to be denied to the same majority of the public by the watering of capital, abuses, and incompetence, then we must expect stagnation, if not decay.

Legislation has proved futile to secure a sound foundation, and technical achievement, publicity of abuses already committed, profit-sharing of capital with labour, or protection by customs tariffs, however valuable or even essential in themselves, do not touch the root of the subject. The discrediting of our primary industries—such as mining, and the consequent postponement of the inception of remunerative undertakings (involving that also of all the dependent industrial and commercial enterprises) for years and even decades, is of incalculable national economic loss. This delay and cost of inception is specially emphasized by Mr. Hoover.

T. H. B. MAYNE.

London, June 3.

### Premature Precipitation.

The Editor:

Sir—In your issue of February, Mr. A. W. Allen criticizes some notes on premature precipitation which I contributed to your January issue. In Mr. Allen's calculation of 76% extraction of valuable contents, he forgot to reckon the gold, which is considered by most cyanide men to be very precious. Had he calculated the gold and silver content together he would have found an extraction of 85% had been obtained. Mr. Allen's information that there are localities where charcoal is used as a precipitant must come as pleasing information to most cyanide men. But he should have used the past instead of the present tense. Had I agitated the pulp with "zinc shavings instead of the unfortunate mixture supplied by nature," there would have been no remaining zinc. It would all have gone into solution, forming zinc potassic cyanide combinations.

DONALD F. FOSTER.

London, May 23, 1912.

# EARLY DAYS AT KALGOORLIE

By H. E. WEST.

PAT HANNAN, in 1892, by chance discovered gold in the alluvium near Cassidy hill, some 30 miles northeast of Coolgardie, during one of the periodical rushes that left Coolgardie as destitute as Goldsmith's 'Deserted Village.' The find was extensive and rich, attracting a crowd of 'dry-blowers,' and soon the embryonic town of Hannan's appeared. Dry-blowing, with the primitive two pans and the friendly breeze, with divers forms of the more elaborate dry-blowing machine, were employed. Water, unfortunately, was unprocurable. It was not long before the contiguous range of low hills attracted the attention of prospectors, and soon the entire area was staked; the hills, rather than any exposure, being the guiding mark, as might be expected from men conversant with the Barrier range in New South Wales. This empirical staking was subsequently amply justified, though strangely enough, the most valuable lodes were not in the vicinity of the richest alluvium.

My advent into Hannan's, or Kalgoorlie, as it was officially named, was early in 1895. Access then was by coach from Southern Cross, the end of the railroad. Owing to some days of heavy rain the roads were obliterated, and the experience was one not easily forgotten. Enteric fever was rampant at Coolgardie. There were the dead and the convalescent. I was in the latter class, having been laid up with fever at Perth a couple of months previously. The journey thither by coach, the constant clouds of red dust, during the hottest month of summer, and the crowded hospital on arrival on Perth, afford another indelible record; indeed, experience came thick upon us in those early days. Sam Cutler, the genial agent of the Equitable, was the sole policy-writer in the district; even the Australian Mutual had recalled its man. Sam did a roaring business, although naturally there were some heavy losses.

Hannan's in 1895, as the stage-coach rattled up the long straggling street, was impressive. On the left was the Post-Office, a 10 by 12 ft. bag shanty, and in the middle of the street was the jail, an iron chain with rings around a gum-tree. These, with a few shanties and a saloon, comprised about all the furnishings. The cutting of the three miles of straight road to the Great Boulder mine was an epoch-making period, and, on a Saturday night, the travel along this highway was impressive.

Bush covered the entire country. Salmon-gum of merchantable size grew everywhere, and Herrick's saw-mill, back of the town, did considerable business, and at a stiff figure. Quondong, quarrajong, ti-tree, and sandal-wood, with a number of aromatic flowering shrubs, formed a thick growth, whose tesselated floor of hematite-nodules was as level and firm as though a steam-roller had passed that way. In the spring-time acres on acres of the level floor was covered with a brilliant mat of everlasting flowers. As the season advanced the blossoming spread to the shrubs and bushes, and finally glorified even the trees, bursting into sweet-scented sprays of mimosa and other myrtles. There was no dust, which plagued the district at a later time when traffic had churned into an impalpable powder the floor of the plain. Dense bush still covered the Brownhill and the Associated hills; though around the Boulder, Lake View, and Ivanhoe, perceptible clearings were in evidence.

'Specking' or spotting gold, after a shower of rain, was a favourite pastime, and much of the alluvial drift was worked for gold in the vicinity of what later came into pre-eminence as 'the golden mile.'

Flies were always a pest in the bush, though mosquitoes were unknown. Scarcity of water was a trouble from the first, and even when Kalgoorlie had some 6000 inhabitants, I have had the unpleasant experience after cycling all the way from Coolgardie against a hot wind-storm, of having to press on to the mine in order to obtain a drink of water. Salt water obtained by sinking had to be evaporated and condensed before it was potable. Water was retailed at 6d. per gallon in those days. At the 'lake,' three miles south of the Boulder, that mine maintained a pumping-plant, delivering water through a 3-inch pipe. A custom battery also adorned the west shore. There was no water at Hannan's lake. Where the evaporation is 8 feet per annum nature wisely buries that priceless commodity beneath the surface of the sand.

During the summer of 1895 'staking' or 'pegging' became general, and the salt-bush

flats, forming a moss-green sea around the low hills, were taken-up for miles around. Subsequent development proved nothing of importance apart from the hills at Kalgoorlie, although this generalization was not true for other districts in Western Australia. In the kaolinized surface between the Boulder and the lake, copious deposits of water were encountered and proved a valuable asset, if not the only one.

Money became plentiful. Prospects sold like hot cakes. Everybody had a prospect and all had money. Almost any grimy 'digger' could write his cheque for thousands, that is, when he first struck town. The original Adelaide syndicate, which sent a prospector to Western Australia in 1893, realized a fortune for each of its six subscribers; each £100, according to popular report, realized some £10,000. It was this syndicate, which included Zebina Lane, George Brookman, De Rose, and Doolette, that secured almost all the better known properties within the Golden Mile, including the Great Boulder, Lake View, and Ivanhoe. 'Bull-luck' was the popular verdict. Be that as it may, the Boulder 'rush' was a mighty factor in those days, and tales paralleling the early days of Nevada and Colorado, of munificent expense, induced by easily won fortune, passed currency.

Justice was indifferently administered by the wardens or local magistracy. The growing town of Hannan's possessed but one lawyer, who was retained by the 'trust,' so that it became necessary to rely on one's own efforts in court—a proceeding not usually attended with success. Meantime Hannan's was growing, the bush was being cleared, and the deposits opened up. Mills were in operation, and others in course of erection. The Croesus, with its primitive 10 stamps was, I think, the first to start. Mount Charlotte had erected a dry-crushing and dry-concentrating plant, to treat the alluvial deposits. This enterprise was not successful. The joint mill of 40 stamps of the Lake View and Boulder started early in 1895, and pounded ore that returned 10 ounces of gold per ton, and for many months. The stamps were light, with an iron frame. There were no breakers, and the mortars were fed by hand from the 'paddock.' Amalgamated plates and blanket-strakes, with a Berdan pan, completed the equipment. The slime was impounded for future treatment and the water returned to the mill. The Kalgoorlie Mint and Iron-King erected a 20-stamp mill, from which much was expected. The North Boulder installed a Huntington mill, for whose efficiency and extraction a great claim was made. The Brownhill erected the first dry-crushing and cyanide plant of 30 tons. This consisted of Sandycroft breakers and rolls, with barrel-amalgamation and sand-leaching by cyanide. Preliminary amalgamation was discarded and direct cyaniding introduced. On sun-dried ore the crushing department worked merrily, but

when the damp mine-ore was tackled the soft schist rolled into dollar-pieces and trouble resulted. Four Hornsby-Akroyd oil-engines of 16 hp. supplied the power. A complete remodelling of the plant took place, a White-Howell dryer was introduced, two No. 5 Krupp ball-mills superseded rolls, a Mumford-Moody separator extracted the fine and dust, a 28-inch 20-chamber Johnson press took care of the slime, and the sand passed to the vats. An

awe-inspiring, rich, impalpable dust was the next bugbear, and as the settled dust on the rafters assayed 10 oz. per ton, it had to be saved. It proved an elusive product.

Contemporaneously the Lake View was installing its new 40-stamp mill on the Lake View hill, with the breakers at the shaft-mouth, an aerial line connecting the two. They were experimenting with a centre-feed filter-press of German make, attempting to cyanide the slime while still within the press. This method, though reported as successful, was not adopted. The small Ivanhoe battery, operated by an oil-engine, was crushing continuously. At the Kalgurli, still owned by the prospectors—two brothers—they had a small mill of two heads worked by a diminutive oil-engine. The tailing from this mine was reported to run 10 oz. in gold. The brothers operated the mine and mill as the exchequer demanded, meantime awaiting a purchaser at £10,000, which was considered an exorbitant figure in those days. They eventually got their price, and the purchasers one of the best little mines ever found.

The early miners coming from Ballarat, Charters Towers, and Gympie, understood quartz; but the wide oxidized orebodies in lodes they did not understand, and consequently failed to recognize. In the case of the Great Boulder it was a quartz stringer that was followed from surface, and when this stringer led to a wide soft orebody, the connection was not at first recognized. However, wide lodes soon became fashionable, and were discovered in all the principal properties. At the Hannan's Brownhill the shaft had disclosed 30 feet of 5 oz. ore, toward the close of 1894. At the Great Boulder, Lake View, Golden Horsehoe, Associated, Ivanhoe, and Perseverance similar developments were taking place. Kalgoorlie soon made a name for itself, and the boom of 1895-'96 was well on the way.

The peculiar occurrence of 'mustard' gold was unfamiliar, and at first this form of the precious metal was said to have found its way to the dump. Doubtless, the clay-like appearance prevented recognition. The same held true with the first appearance of gold-telluride compounds, until recognized, in the dump of the Boulder Main Reef in 1896, although Mr. J. C. Moulden, in May of that year, was locally accredited as the original discoverer on samples submitted to his inspection at Coolgardie. The compounds encountered were calaverite, coloradite, petzite, with native tellurium. Many of the exposures underground were inspiriting. At the Kalgurli mine one carefully guarded face showed telluride in splashes and seams in a

*KALGOORLIE IN 1897.*

truly resplendent manner. At the Brownhill, in what Julian Price called the Aladdin's Cave, the delicate and lavish deposition of filmy gold on the green chloritic schist presented a truly remarkable sight. The first shipment from this mine, taken across 60 feet of the north end of the shoot, shipped to the eastern smelters, returned 10 oz. gold per ton. At the Great Boulder 700 ounces of pure filigree gold was taken from one pocket. This was exhibited at a bank in Kalgoorlie, and afterwards shipped to London, to rest finally in the South Kensington museum. In the Perseverance mine at the 70-ft. level, the width of orebody and lavish display of oxidized and telluride ore formed one of the special local features. Though there was a similarity in all the ores, the texture varied considerably, increasing in silica content westward, with a minimum along the Brownhill belt, and a maximum at the Ivanhoe. The practised eye could readily spot from what particular mines the specimens originated, although they presented a confusing similarity to the uninitiated.

Reverting again to the milling. Hannan's Brownhill started as the exponent of dry-crushing, and evolved a practical and efficient process. In 1898 this principle was further elaborated by the erection of the Pape-Henneberg mill on the Brownhill, using revolving dryers, ball-mills, air-separators, sand-percolation, and 5-ton Dehne presses, hydraulically operated. This was the highest development in treating oxidized ore. The sulpho-telluride ore was now being developed and called for adequate treatment. To this end the Diehl process was introduced, embodying the use of bromo-cyanide, although this oxidizer had been previously introduced by H. L. Sulman, together with precipitation by zinc-fume, both at Bayley's Reward and in the Murchison district.

The Lake View mill was reorganized in 1899, adopting the Diehl process, which consisted of the wet-crushing of the raw sulpho-telluride, followed by concentration and fine-grinding of the concentrate, and then bromo-cyanide treatment with filter-pressing. At the Great Boulder, on the other hand, a dry-crushing mill was erected using Ropp furnaces for roasting the sulpho-telluride ore, with subsequent reduction, cyaniding, and filter-pressing. The Brownhill also erected stamps and adopted wet-crushing with the Diehl process. So there was brought about rather a curious reversal of principle, the advocates of the dry-crushing process adopting the wet, and the wet crusher reverting to dry crushing. There were advocates of both systems, each presenting a plausible case in terms both of extraction and cost.

By the close of the century the 'early days' had passed. A fitting climax was afforded in that remarkable production of the Lake View mine in 1899, under H. C. Callahan, when for months the bullion production was maintained at over 30,000 oz.—a hitherto unparalleled feat, though since eclipsed in the case of the Esperanza mine, in Mexico, and the Goldfield Consolidated, in Nevada. As an instance of the rapid rise in the market-value of shares, I may cite the record of this particular mine, for the shares of which in 1895 I had offered 3s. per share. By a series of rapid advances they eventually reached a quotation of £29 per share.

By 1900 the bush-trails and dust-roads had given place to car-service and railroad. The Boulder townsite stretched over the desolate salt-bush flat of other days. Old Hannan's, now Kalgoorlie, wore the air of a city, with its hotels and substantial business-blocks. Town lots had advanced from a few hundreds to many thousands of pounds. Smoke-stacks, mills, and hoist-houses dotted the landscape. All timber had been felled and the bush cleared for many miles, so that dust from the furrowed surface swept the town and made life a burden. Fresh water was pumped in millions of gallons daily from the coast range; the days of drought were ended. 'Damper,' 'spotted dog,' and the prospector were relegated to the back blocks.

The familiar strings of camels laden with freight for the interior had also vanished before the advent of the iron horse. The free open tent-life had given place to the regime of locks and bars. The Melbourne 'larrikin' and his 'bell-bottom pants' were as thick and vicious as the imported mosquito. Sand-bagging was a nightly occurrence. The railway had brought a horde of camp-followers unwilling to face the hardship of the long trail. Blacks and jins, with their 'corroborree' at the new moon, had gone the way of the emu and iguana. The unconventional comradeship, common to all early camps, had given place to the stereotyped life of established order, to the hum drum routine of the pulsating gold producer. The early days of Kalgoorlie had passed.

Verily, time is the healer of all wounds. To many of us of the old brigade, scattered to the four winds of heaven, added years and experience of many climes temper the vicissitudes and enhance the memory of those early days.

# CONDITIONS IN MEXICO

By F. W. OLDFIELD.

SO much has been written on Mexico, and so varied are opinions expressed concerning the revolution, that I should hesitate to write on the subject had I not just returned from Mexico. Thoroughly to appreciate conditions obtaining there, an intimate knowledge of the country, its people, and its 'questions' is required.

For thirty years, under the rule of Porfirio Diaz, the country was quiet, prosperous, and progressive, by methods that, judged by the results, were peculiarly fitted to local circumstances. These methods, compared by the standards of other countries, were often autocratic and dictatorial, but they were sufficient for the day, although impossible of transmission to a successor. Elections were outwardly free, but always with the same result: the election of the official candidate. Thus matters continued until the advent of Francisco I. Madero as candidate for the presidency in 1910. This candidacy was comparatively insignificant at the time and probably would have been forgotten but for the unnecessary and unwise move of placing Madero in jail until after the elections. How he was afterward released on bond, how he forfeited his bond, how he started and carried through his successful revolution, all the world now knows. In the earlier stages of that revolution it was not dreamed by one-tenth of the country that he would be successful ultimately. His success demonstrated the absolute unpreparedness of the Government, and showed that the Latin-American revolutionary germ was not dead, but only dormant. The Mexican suddenly found that he might give vent to his feelings and air his ideas with impunity.

In due course Madero was elected to the presidency of the Republic on a platform of "effective suffrage" and "no re-election," with promises of a distribution of public lands and a division of the large estates among the poorer class. This programme was one difficult to carry out; it proved impossible almost from the start. As the promised reforms have not been effected, the new President has become unpopular; this, coupled with alleged tactless actions on his part, caused another revolution.

*FEDERAL TROOPS IN PURSUIT OF REBELS.*

There are 15,000,000 people in Mexico, the majority belonging to the working class. Most of them are illiterate, uninformed, and totally incapable of appreciating, much less taking

advantage of, the 'Sufragio Efectivo.' The distribution of the public lands means little, for the simple reason that little arable public land exists; moreover, the partitioning of the large estates can only be accomplished by the Government in normal times, when the credit of the country is in a flourishing condition and sufficient opportunity has been given for well considered taxation, to make the process automatic rather than compulsory.

The undiplomatic acts charged against President Madero are that he stumped the country for the vice-presidential candidate, thereby laying himself open to the old charge against Diaz, namely, indicating his successor; and that he has unduly favoured his family, flouted his friends, and failed to reconcile his enemies. As one prominent Mexican put it to me, when Diaz gained his ascendancy he helped all his friends, and as for his powerful enemies, why, he took good care to help them also.

The present revolution is being waged, professedly, on exactly the same platform as the last one; in reality it is more probable that it was caused by the dissatisfaction felt by former Maderistas at the way they consider they were treated by the successful leader of their own party. It is idle to suppose that the whole country is in favour of revolution, but the last one was so easy, the appetite for cross-country riding had been whetted, and the response to the call to arms was so prompt that the revolution quickly reached as serious a stage as the similar lawlessness at the time of the resignation of Diaz.

The character of the country is so mountainous, the telegraphic communications and railroads are so easy to put out of commission, that quick movement of troops is extremely difficult. Thus everything lends itself admirably to guerilla warfare. Soon the whole of Chihuahua (with the exception of Ojinaga) was in the hands of the rebels, who ran the railways, levied and collected taxes, and administered the Custom House at Juarez. In the southern part of this State, Orozco was able to command a well-organized army of 6000 men confronting the main army of the Federals. In Tepic the Government is holding its own in the capital, but is not sufficiently strong to patrol the rest of the territory. In Sonora and Sinaloa chaos reigns. In Morelos, Zapata is operating with some 2000 men, while many other States, though nominally in the hands of the Government, are subject to marauding bands of pseudo-revolutionists.

Business is necessarily at an absolute standstill, and for the most part mining is only carried on in the larger camps, where the foreigners have fortified themselves and provided themselves with rations, arms, and ammunition. Development of new enterprises has completely stopped, and all foreigners who could get away have left the country. At El Paso, Texas, alone, it is claimed there are 10,000 refugees, while in cities like Guadalajara, where foreigners were plentiful, it is now rare to meet any on the street.

The exodus of foreigners and the closing down of many properties has accentuated conditions, for many of the men thus thrown out of work have joined revolutionary bands, a pursuit not unpleasurable, for the *revoltoso* can ride his neighbour's horse, carry his neighbour's gun, demand food and funds, and, above all, expose himself to little danger. The favourite method is for a band, 200 to 400 strong, to fall upon a small town and demand its surrender. Should it accede, the band levies certain sums of money on the chief merchants, which sums are generally paid promptly. In case the town refuses to surrender, it is forthwith attacked, and, if successfully taken, larger assessments are demanded; and, in the event of these not being paid, the town is subjected to sacking for a few hours.

As yet the foreigners remaining in the country have been comparatively free from molestation, but always with an uneasy feeling that anything may happen, such as took place during the Madero revolution at Torreon and Pachuca. The American proclamation caused the exit of many foreigners; it gave the Mexican a false feeling of independence and made conditions exceedingly onerous for those who remained. It is for them to attend strictly to business and avoid any participation in the internal strife.

The outcome of this revolution is still obscure. For long, on all sides the rebels gained ground, and, plotting a curve of their achievements, their cause assumed healthy proportions. The recent success of the Government in Chihuahua against Orozco's main army came just in time, for the result of this meeting was considered a crucial one, and certain to affect the morale of the troops. The defeat of these rebels somewhat clears the atmosphere, but they are still capable of giving much trouble by finally splitting into flying columns and operating in the hills in a similar way to the followers of Zapata, who, for over a year, have been able to maintain themselves in the fastnesses of the mountains south of Mexico

City. In any event it will certainly take the Government a long time to complete the pacification of the country. On the other hand, the success of the rebels would mean the same set of conditions as heretofore. The matter is rendered all the more difficult by the apparent apathy of the better class of Mexicans, who, instead of supporting the Government, are seeking safety in foreign countries. It must be conceded that lasting peace can be gained only by supporting the constitutional Government; this calls for genuine patriotism.

Settlement of the matter by intervention of its questions in the only way it knows. All those interested in mining will hope that it may come through the ordeal successfully.

## Copper Production in 1911.

The *Engineering and Mining Journal* gives in the table below its final figures for the production of copper throughout the world during 1911, together with those for 1910. Those marked (*a*) are our contemporary's own estimates; (*b*) those of Henry R. Merton & Co.; (*c*) as officially reported; (*d*) privately communicated. The figures are carefully sifted, so that they shall represent the production from the countries of origin.

*BUILDING A ROAD INTO BOLANOS FOR THE MEXICAN MINES CO.*

the United States is the last thing wanted. The good faith of the United States would never be accepted by the Mexicans, for they have not forgotten the loss of the fairest part of their country sixty-five years ago, and such a procedure would mean a tight place for many a foreigner now in the country. It would cause the immediate cementation of all Mexico against the intervening party. That it will be requested by either side is generally considered inconceivable. Yet so complicated is the situation that intervention appears not wholly improbable.

This is the sorry plight of a country that has attracted millions of foreign capital, which capital has been largely instrumental in the industrial progress of a region rich in a great variety of minerals. Mexico is going through a process of social evolution not unknown even in more advanced countries and it is tackling

PRODUCTION OF COPPER IN METRIC TONS

| Country | 1910 | 1911 |
|---|---|---|
| United States | (*a*) 492,712 | (*a*) 491,634 |
| Mexico | (*a*) 62,504 | (*a*) 61,884 |
| Canada | (*a*) 23,810 | (*a*) 25,570 |
| Cuba | (*a*) 3,538 | (*a*) 3,753 |
| Australasia | (*b*) 40,962 | (*b*) 42,510 |
| Peru | (*c*) 27,375 | (*a*) 28,500 |
| Chile | (*a*) 38,346 | (*a*) 33,088 |
| Japan | (*c*) 50,703 | (*d*) 52,303 |
| Russia | (*b*) 22,700 | (*b*) 25,980 |
| Germany | (*b*) 25,100 | (*b*) 22,363 |
| Africa | (*b*) 15,400 | (*b*) 17,252 |
| Spain and Portugal | (*b*) 51,100 | (*b*) 52,878 |
| Other Countries | (*b*) 28,100 | (*b*) 29,373 |
| Totals | 882,350 | 887,088 |

# COPPER MINES OF THE URAL REGION

By H. W. TURNER.

THE Ural mountains consist of a series of ridges extending in a north-south direction for approximately 1900 miles. Geologically the range constitutes a tectonic and petrographic zone composed of sedimentary rocks of Devonian age (slate, schist, and limestone) and igneous rocks of great variety comprising metamorphic lavas and lava-ash rocks, and basic intrusive igneous rocks (diabase, diorite, gabbro, serpentine), and also more acid rocks, such as quartz-porphyry and granite. These Devonian sedimentaries and associated igneous rocks form the main mineral-bearing zone of the region, characterized especially by iron and copper deposits, and likewise the source of most of the gold and platinum of the placers.

There are also large areas of granitic and gneissic rocks, supposed to be pre-Cambrian in age and regarded as the oldest rocks of the range. These areas contain some magnetite deposits, quartz veins, corundum, and precious stones, but so far as known no copper lodes of importance.

Lying on the west flank of the Urals there are vast areas of Permian and Carboniferous sedimentary rocks containing iron and copper deposits, the latter associated with the Permian beds. The copper ores of the Permian are usually of an oxidized character with low content of copper and will not be described in this article. To the east of the Devonian mineral zone lie the nearly level treeless Siberian steppes, largely blanketed with Tertiary deposits lying on a basement of crystalline schist and other rocks.

## CONTACT-METAMORPHIC COPPER DEPOSITS.

Copper mining has been an important industry in the Urals for at least 170 years. Naturally the deposits first discovered were those exhibiting the bright coloured carbonate ores at the surface and in this region these are largely of the contact-metamorphic type, formed as the result of the intrusion of igneous rocks into other formations. Ores of this nature are silicious in composition and the deposits have an irregular shape. Consequently mining and smelting costs are both higher than with the pyritic deposits hereafter described. Fortunately the copper content also is often higher. The mines that have in the past furnished the bulk of the copper of the Urals are mostly of this type, the principal ones being at Bogoslovsk, Mednorudiansk near Nijni Tagil, Gumeshevsk, Pyshminsk, and those near Soymonovsk. Of these the Bogoslovsk mines are much the most important.

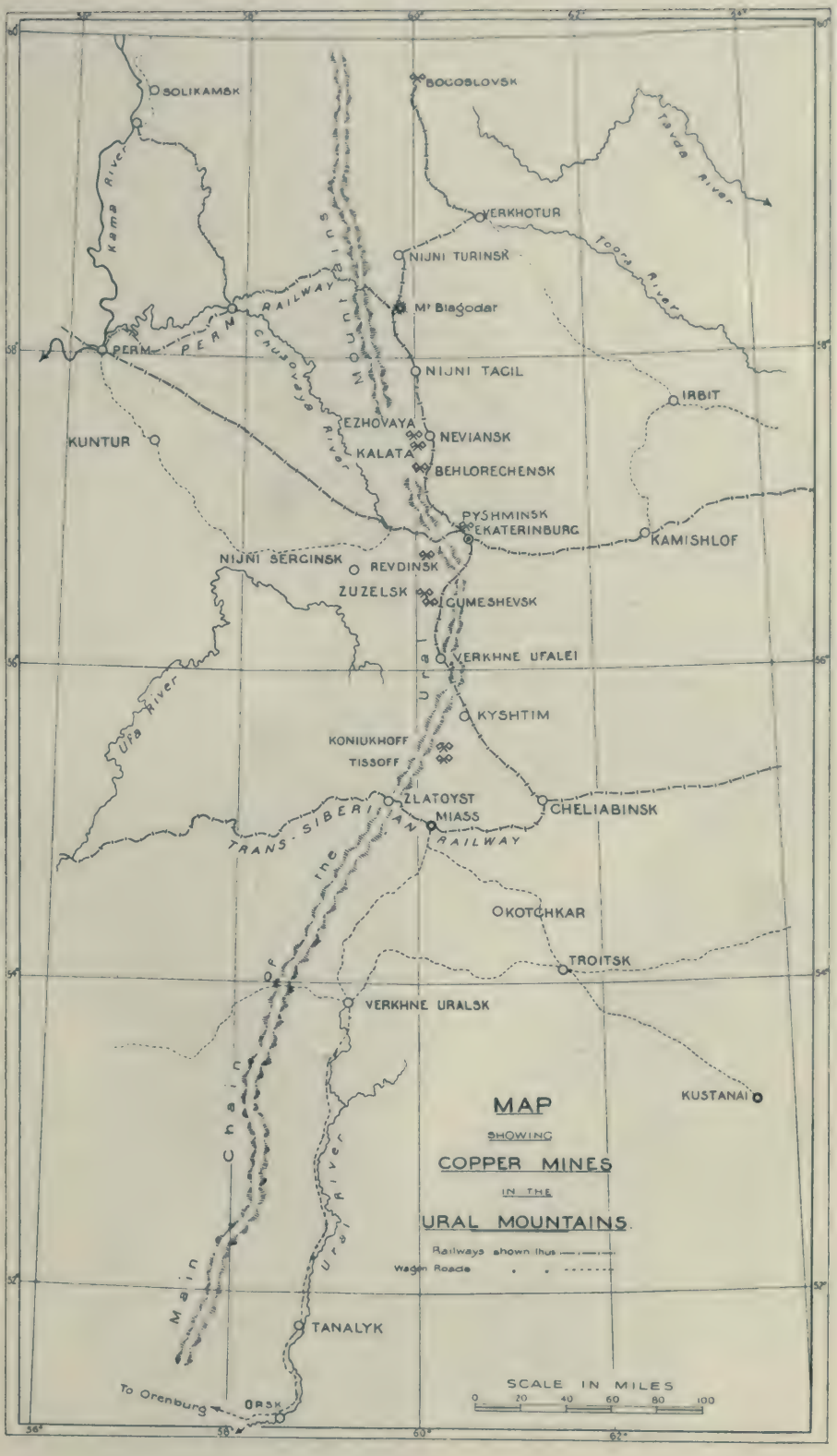
BOGOSLOVSK.[1]—Copper mining began at Bogoslovsk in 1745 and copper smelting in 1765. The ores occur chiefly at or near the contact of augite-garnet rocks with porphyry or Devonian limestone, the garnet rock itself being the product of contact-metamorphism, probably caused by the adjacent hornblende-granite and porphyries. The ore deposits extend over a distance of three miles and are irregular in distribution. Both the wall-rocks and the lodes are cut by later porphyry dikes. While carbonate ores prevailed in the upper workings, in depth the ores are chiefly sulphides, namely, chalcopyrite, pyrite, and pyrrhotite, with considerable bodies of magnetite. There are six or more distinct mines. Shockley gives the total cost for 1903 as £63·4 per long ton of copper, which would give no profit were it not for the import duty of £33 per ton.[2] The ores are treated in blast-furnaces with charcoal fuel and refined in modified Manhès converters. The following is an average of five analyses given by Shockley of ores from different mines. It illustrates the silicious character of the ore:

| | % | | % |
|---|---|---|---|
| Copper | 6·32 | Alumina | 3·17 |
| Iron | 20·71 | Lime | 14·90 |
| Sulphur | 17·81 | Magnesia | 3·01 |
| Silica | 33·93 | Manganese | 0·48 |

MEDNORUDIANSK.—Situated near Nijni Tagil, this mine has been in operation since the early part of the 19th century. The ore occurs in clay between limestone walls, and is entirely oxidized. At the north end are bodies of magnetite containing chalcopyrite. Green schist and feldspathic rocks are found in the workings, the latter probably being the origi-

[1] W. H. Shockley, Trans. Am. Inst. Min. Eng. Vol. XXXIX, 1908. E. S. Federov and V. Nikitin, 'The Mining District of Bogoslovsk,' St. Petersburg, 1901, in Russian. R. Beck, Lehre von den Erzlagerstätten, Berlin, 1909.

[2] The actual import duty on copper in the Russian empire is 5 roubles per pood or nearly £33 per long ton. The price delivered in Moscow or Petersburg is therefore the London price plus the duty. However the large buyers usually buy the copper delivered at the nearest railway station franco, deducting freight charges to Moscow or Petersburg. Thus the price paid railway station franco in the Urals is about £27 above the London price.


SOLIKAMSK
BOGOSLOVSK
Kama River
Tavda River
VERKHOTUR
NIJNI TURINSK
Tura River
M. Blagodat
PERM
PERM RAILWAY
CHUSOVAYA
NIJNI TAGIL
IRBIT
KUNTUR
EZHOVAYA
NEVIANSK
KALATA
BEHLORECHENSK
PYSHMINSK
EKATERINBURG
KAMISHLOF
NIJNI SERGINSK
REVDINSK
ZUZELSK
CUMESHEVSK
VERKHNE UFALEI
Ufa River
KYSHTIM
KONIUKHOFF
TISSOFF
ZLATOYST
MIASS
CHELIABINSK
TRANS-SIBERIAN RAILWAY
OKOTCHKAR
TROITSK
VERKHNE URALSK
KUSTANAI
MAP
SHOWING
COPPER MINES
IN THE
URAL MOUNTAINS
Railways shown thus
Wagon Roads
Main Chain of the Ural River
TANALYK
To Orenburg
ORSK
SCALE IN MILES
0 20 40 60 80 100

nal intrusive rock and the primary cause of the deposit. The lime walls of the clay beds have been in places metamorphosed to garnet-pyroxene rocks. There is little doubt therefore of the contact-metamorphic nature of this deposit, the original copper minerals having been entirely changed by oxidation to carbonates and oxides of copper. In 1835 a mass of malachite weighing 328 tons was found at a depth of about 240 feet.

EZHOVAYA.—This mine, on the Werkh-Issetsk estate, is said to be at the contact of limestone and schist. It was worked to a depth of 260 ft., and abandoned in 1847. The ore occurred in clay, like that at Mednorudiansk, and is said to have averaged 10% copper. Nikitin considers that the orebodies are not exhausted.

GUMESHEVSK. Situated on the Syssert estate, this formerly extensive mine is also similar to the Mednorudiansk. A large lens of Devonian limestone is intruded by a long diorite dike, about 150 ft. wide. Lying between the crystalline lime and the dike are heavy beds of clay containing oxidized copper ore. The diorite itself contains sulphides, as shown by a drift into it from a shaft about 500 ft. deep. The mine was operated for over a century, being discovered about 1727 and closing down in 1871. Recently the clay has been leached with sulphuric acid solutions in an ingenious plant erected by August Hoffmann, which has been fully described by A. L. Simon.[1]

SOYMONOVSK.—Near the village of Soymonovsk, on the Kyshtim estate, at the contact of crystalline limestone and serpentine, and crystalline limestone and schist, are several deposits worked chiefly in the last century that are essentially similar to the Gumeshevsk. The ores were oxidized and occurred mostly in clay, but in the Sugursky mine a considerable amount of pyrite has been found in recent years.

PYSHMINSK. — Although included under contact-metamorphic deposits, the cupriferous schist of the Pyshminsk mines resembles the impregnated schist that is adjacent to the pyritic lenses subsequently described. From the descriptions the chief difference appears to be a higher content of chalcopyrite. Beck[2] characterizes the deposits as fahlbands or zones of impregnation lying between uralite-porphyrite and dioritic rocks in chlorite schists containing magnetite crystals. Certain streaks are strongly impregnated with iron and copper pyrite averaging 7% copper. The schist near the pyritic orebodies on the Kyshtim estate and that adjacent to the ore in the Hope shaft of the Zuzelsk mine on the Syssert estate is essentially similar, and often contains enough copper to be treated as ore. Sometimes it contains more gold and silver than the pyrite itself.

As may be seen by referring to Nikitin's report,[1] the orebodies or zones of impregnation are not all parallel and in the Vasilevsk mine there is a branch of the main lode having an orebody at the junction and giving the deposit a vein-like appearance. One bed of ore dips at an angle of about 45°, but the others are steeper. At the Pokrovsk mine the ore ceased to be profitable at a depth of 245 ft., while at the Ivanovsk there were three feet of good ore at the same depth. The present workings are probably much deeper. The ore in the upper workings was oxidized and the following analysis will give an idea of its character. This is an average of four analyses published by Nikitin.

| | % | | % |
|---|---|---|---|
| Hygroscopic water | 2·71 | Lime | 1·17 |
| Loss on ignition | 9·07 | Magnesia | 1·19 |
| Silica | 31·14 | Sulphur | 2·08 |
| Alumina | 6·25 | Copper oxide | 13·25 |
| Ferric oxide | 32·72 | Copper | 10·59 |

Between 1900 and 1905, 25,098 long tons of ore were smelted, producing 1690 tons of copper, or 6·7%, indicating a copper content in the original ore of over 7%. The total copper production from 1900 to 1910 inclusive was about 6200 long tons. Rather recently a water-jacket blast-furnace is said to have been installed.

PROSPECTS.—Scattered all along the main chain of the Urals are hundreds of prospects showing copper ore. Many of these were opened up at the time when convict labour was employed in the mines and copper ore was extracted from many of them. No doubt further development work will show the existence of commercial orebodies in a few of these prospects, some of which are in serpentine and other igneous rocks, and some at various contacts. The ore developed in the shallow workings is mostly oxidized.

## PYRITIC COPPER DEPOSITS.

The mines described under this head are essentially similar to the Rio Tinto and other deposits near Huelva, in Spain, and consist of lenses and sheets of massive pyrite in schist and greenstone. In the schist, the deposits

[1] Trans. Inst. Min. and Met., London. Vol. XIX, 1910.
[2] 'Lebre von den Erzlagerstätten,' Berlin, 1909.

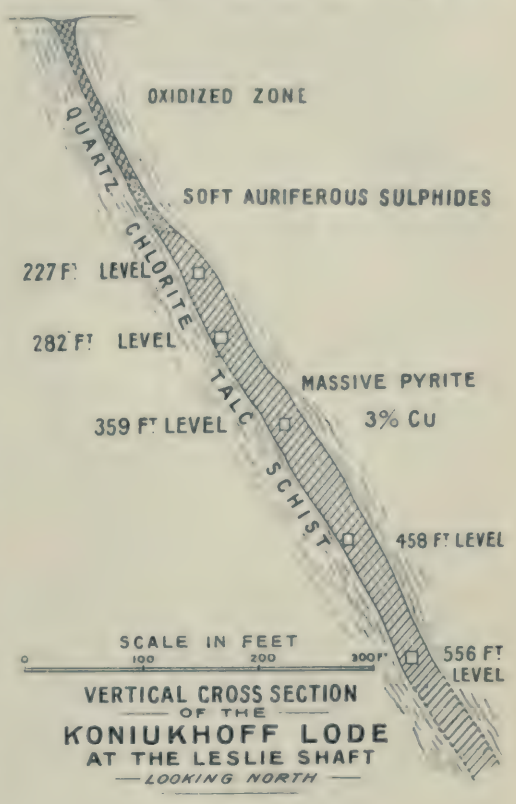
[1] V. Nikitin 'The Werkh-Issetsk Estate.' Mem. Com. Geologique. New Series No. 22, St. Petersburg, 1907, in Russian.

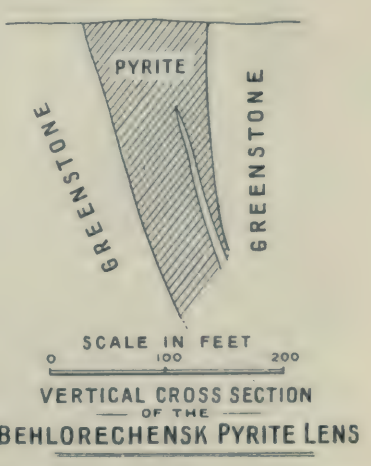
are relatively narrow and deep, and in the more massive greenstone they are lenticular, thicker, and not so deep. The ore consists mainly of pyrite with later interstitial chalcopyrite, and some zinc-blende and galena. The order of deposition is the same as given by Finlayson[1] for the Rio Tinto ores: pyrite, chalcopyrite, zinc-blende. There are the same later veinlets containing rich ore sometimes in depth and the same inclusions of schist so well described by Collins.[2]

In the Ural mines the later veinlets fill joint-seams in the wall-rock, and sometimes in the massive pyrite. These joints usually stand nearly vertical and strike at about right angles to the orebodies. Such veinlets are composed of rich copper ores, chalcopyrite or tennantite, associated with white vein-quartz or sometimes with crystals of barite. While distinctly later than the massive bodies of pyrite, it is not clear that they are deposited by descending waters. Indeed, it would be interesting to know if ordinary white vein-quartz is ever deposited from descending surface waters. Certainly it is ordinarily regarded as being formed from ascending warm solutions.

The pyrite deposits usually conform in strike and dip with the enclosing schist. This is no evidence of their being beds originally deposited with the sediments, for the schistose structure is itself secondary, being the result of pressure and metamorphism. Moreover the pyrite lenses sometimes send off branches, as in the Smirnoff mine, suggesting a pre-existing fissure or line of weakness along which the solutions penetrated. In all cases the pyritic ores are plainly the result of impregnation of the schist and the greenstone by the sulphides. Every gradation can be traced from non-mineralized rock to massive pyrite, and the pyrite itself frequently shows banding parallel to the schist walls, as was noted by Knox.[3] Some of the gossan outcrops near the productive mines were found, on drilling, to cap streaks of schist highly impregnated with pyrite, and not solid pyrite.

Ores of massive pyrite are especially desirable. Although they mostly average only 3% copper, they are cheaply mined on account of their compact nature, and they are cheaply smelted, as the sulphur of the ore serves for fuel, so that but little coke is required. Moreover, as the addition of silica is required as a flux, any adjacent gold-quartz ores can be treated at a minimum of cost in the same operation. The total cost in well situated properties is from £30 to £40 per long ton of copper produced. Thus these ores compare favourably with the disseminated type of copper sulphide deposits.




KALATA.—This mine is on the Werkh-Issetsk estate and is an old discovery, for pyrite

[1] A. M. Finlayson, Trans. Inst. Min. and Met., London, Vol. XX, 1910.
[2] *The Mining Magazine*, Vol. V, page 121.
[3] H. H. Knox, Trans. Inst. Min. and Met., London, Vol. XVIII, 1909.

was mined on the 50-ft. level in 1813.[1] In recent years there have been extracted about 100,000 tons of ore containing about 2·5% copper. This has been shipped and sold for its sulphur and copper contents. The waters of the mine are said to contain about 0·08% copper, which is precipitated on scrap-iron, producing about 30 tons of copper annually. On the 280-ft. level, the pyrite is said to have contained about 2% copper, while on the lower levels 2·8% is claimed, indicating an increasing value with depth. As will be seen in the table of analyses, the pyrite contains a little gold and silver, and no barite. At some points, I found little veins of white vein-quartz and chalcopyrite filling joint-seams in the walls and in the solid pyrite itself. The joints strike nearly at right angles to the orebody and are nearly vertical. Approximately horizontal joints also were noted in the pyrite. At one face there is so much magnetite that the ore is not valuable for sulphur. The magnetite and pyrite occur in part in narrow interlaminated seams. The country-rock is greenstone.

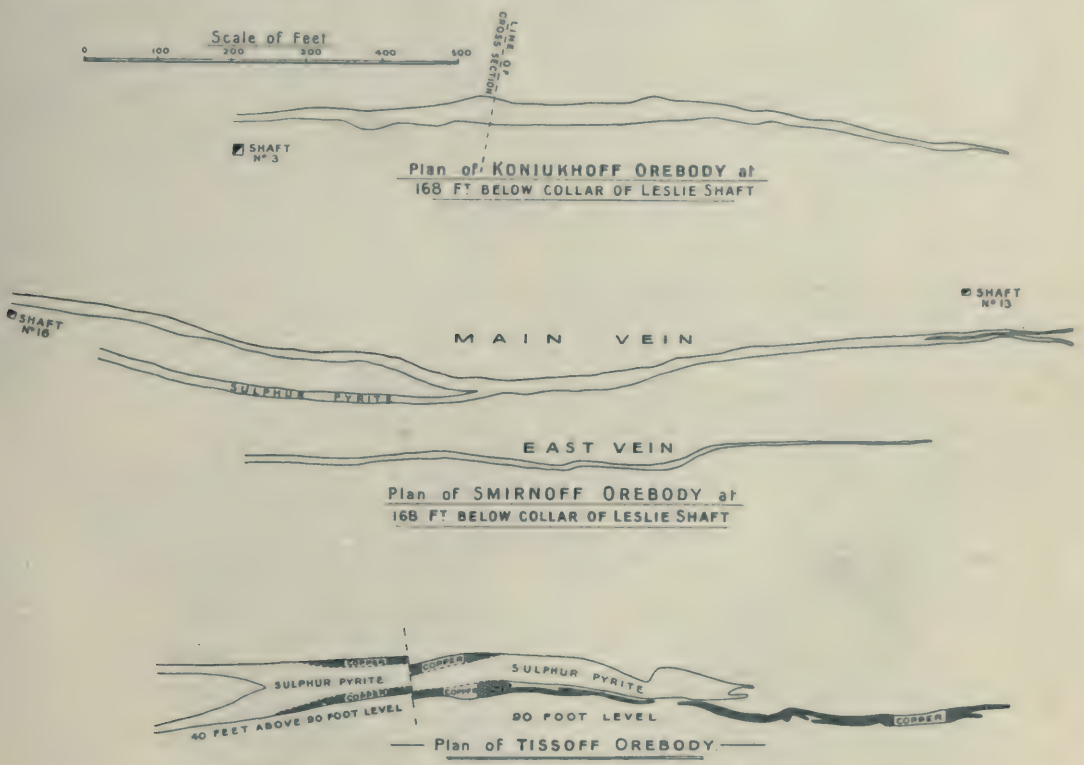
BEKLORECHENSK.—This mine, also on the Werkh-Issetsk estate, is a comparatively recent discovery. The deposit now worked consists of a lens of pyrite estimated by Nichols as about 900 ft. long and 160 ft. wide. The country rock is greenstone, shown on Nikitin's geological map as metamorphic lavas and lava-ash rock. In the thin sections of my specimens, original porphyritic quartz was noted, so that at least a part of the rock is quartz-porphyry. In general, the rock has the same appearance as that at Kalata and, as there, is frequently schistose, especially near the ore. Drilling in the bottom has shown that the pyrite extends to a depth of at least 260 ft., and a lateral drill-hole from the bottom of a shaft sunk in the lens penetrated two other lenses. The deposit differs from the Kalata in containing less copper and more gold and silver (about 10 shillings per ton). There are here also the later veinlets of quartz and chalcopyrite cutting the massive pyrite, like those noted at Kalata. The main lens is capped by a sheet of gossan 20 to 60 ft. thick, the division line between the oxidized and unoxidized ore being quite sharp. This gossan contains about 34 shillings per long ton in precious metals, which are extracted by the cyanide process at a good profit. Neither the pyrite nor the gossan contains barite, as determined in the Karabash laboratory. The gossan capping was omitted by error in the vertical section of the lens.

[1] Private report by H. G. Nichols; and V. Nikitin, The Werkh-Issetsk Estate, St. Petersburg, 1907.

ZUZELSK.—This mine on the Syssert estate consists of two different deposits. One of these is a large lens opened up by a big pit; the other (the Hope mine) consists of a series of relatively small orebodies lying in green schist east of the big lens. The Hope mine is operated through shafts. The influence of the country-rock on the shape of the orebodies is illustrated in these two adjoining properties, those in the hard and more massive greenstone being lenticular, wide, and apparently not very deep, while those in the green schist are tabular when of any size and much deeper in proportion to their width. Bores under the big lens showed ore at a depth of about 300 ft., but as other bores between this deep ore and the main body are said to have found nothing, it is likely that the deep deposit belongs to an entirely different orebody. In the Hope mine a nearly horizontal fault displaces the ore lenses for a few feet, and in the big pit at the south end of the rich ore there are indications of movement in crushed ore and slip-seams; but no evidence of extensive faulting was noted. The rich copper ore of the big lens forms an oval body near the middle of the pit and is divided rather sharply from the sulphur ore, which constitutes most of the big lens. There is also a smaller lens of cupriferous pyrite farther south as shown on the map.

The country rock of the big lens may be designated under the general term greenstone, comprising a variety of basic igneous rocks: diabase, gabbro, and amphibolite. The green schist of the Hope mine is no doubt derived by shearing and metamorphism from igneous rocks. The ores of the Hope mine affords considerable evidence of secondary enrichment; much of it contains over 10% copper and shows black seams and specks, presumably copper glance or covellite. The walls adjacent are in places badly leached by acid water, the result being a rock light in colour and in weight. The schist walls are cut by little veinlets of white quartz containing a black powder, which was found to be rich in copper and is no doubt secondary from chalcopyrite. These veinlets fill joint-seams standing nearly vertical and about at right angles to the ore-sheets; they are probably identical as to time of origin with those noted in the Kalata. Neither the gossan nor the pyrite of the Zuzelsk pit ore contains barite as reported by Hoffmann; but the Degtyarsk and Panovsk gossans on the same estate contain barite. The copper ore is smelted in a modern water-jacket blast-furnace and the sulphur ore is used for making sulphuric acid at a plant on the same estate.

KONIUKHOFF, SMIRNOFF, AND TISSOFF. —The copper mines of the Kyshtim estate are all essentially similar and consist of sheets or tabular lenses of massive pyrite up to 1400 ft. in length and 50 ft. in thickness, enclosed in highly compressed schist, which near the ore is largely made up of quartz with much chlorite and talc. This schist forms a narrow band, often less than 300 ft. wide, extending in a north-south direction for about 20 miles. Nearly everywhere this schist is impregnated with pyrite or magnetite, and it is recognizable by being iron-stained and light in colour. To the east of this narrow zone of schist at the Koniukhoff and Smirnoff mines, there is a narrow layer of a silicious sedimentary schist traceable for several miles and enclosed in greenstone schist. The prevailing country-rock westward is also a greenstone-schist originally lava or lava-ash. To what extent the narrow belt of mineralized schist containing the ore represents originally igneous material it is difficult to tell, on account of the profound metamorphism, especially near the ore, but the less mineralized portions frequently show crushed feldspars under the microscope and a white feldspathic schist found often near the ore is certainly igneous. The feldspar of the white schist is andesine. There are serpentine [1] ridges both east and west of the various schists above described but no intrusive igneous rocks are immediately adjacent to the ore-bodies, so far as determined at this date, unless some of the schists themselves represent such rocks. There is often much calcite in the schist and even a small lens of lime carbonate was found in cross-cutting in the Smirnoff mine, but there are no lime bodies of any size near the ore. In general all the lenses of ore dip east with the enclosing schist at an angle of about 60°.




*PLANS OF THE OREBODIES IN THE KYSHTIM MINES.*

The Koniukhoff lens at its outcrop has a length of about 950 ft. and has been proved by drill-holes to extend to a depth on the dip of about 1000 ft., the width of the ore at that depth being 11 ft., making it probable that the deposit will extend deeper. The Tissoff lenses taken together (and they are separated merely by a layer of schist where they overlap) have a length at the outcrop of about 1200 ft., and as a drill-hole went through 23 ft. of pyrite at

[1] Serpentine is spoken of for convenience as an igneous rock, whereas it is really a metamorphosed rock formed from the alteration of original peridotite (olivine rock).

a depth on the dip of about 900 ft., it is altogether likely that this lens likewise extends to some depth.

The average copper content of the ore is about 3%. In the case of the Koniukhoff this average holds with the cores of the deep bores, so that secondary enrichment does not seem to account for the tenor of ore now being mined at a depth of from 400 to 500 ft. and especially of the 3% ore of the deep drill-holes. As the upper 200 ft. of the lode was leached of its copper content, it is altogether probable that the first levels of the cupriferous pyrite showed plain evidence of enrichment, for the leached copper must have been deposited somewhere. The workings of the Tissoff are still comparatively shallow and the effect of enrichment from surface waters is noticeable on the 90-ft. level and in the open pit. The ore here is more or less oxidized and shows black stains, presumably glance, and crushed grains of pyrite cemented by chalcopyrite. Such ore often assays over 6%, while the grade in depth is distinctly less. Nevertheless the cores at a depth of 900 ft. show commercial copper ore (2·25%) thus comparing favourably with the Huelva deposits, where the copper content often falls below 2% at a depth of from 300 to 600 feet.

Secondary impoverishment is a term introduced by H. H. Knox [1] where *sulphide* ore has been leached of its copper content without oxidation of the pyrite. The sulphides of this zone, which lies between the upper gossan and the lower cupriferous pyrite, are soft and easily mined, and although lacking in copper they contained an unusual amount of gold, presumably leached from the gossan zone. This ore was treated by the cyanide process. In the Koniukhoff the soft sulphide [2] zone was only a few feet thick, but in the Smirnoff it reached a thickness of 30 ft. Mr. Knox states that he observed a similar phenomenon in the Rio Tinto mine and this is confirmed by Finlayson.[3]

In general the schist and orebodies conform in strike and dip, the latter being clearly the result of the replacement of the former. The preference of pyrite for schist is strikingly shown at the Kyshtim iron mine, where there are interbedded layers of marble and schist. All of the ores contain barite. Composites of the pulps of the mine samples for the month of August 1911, assayed at the Karabash laboratory, showed the following amounts of barite.

| | |
|---|---|
| Smirnoff | 5·4% |
| Koniukhoff | 4·8% |
| Tissoff | 9·6% |
| Average | 6·6% |

In the schist walls there are frequently small quartz veins containing a brittle greyish black mineral rich in copper and arsenic; this appears to be tennantite. At one point in the Koniukhoff mine 400 ft. on the dip below the collar of the Leslie shaft, the pyrite was cut by a later seam consisting of a white soft silicate, clear crystals giving a blowpipe reaction for barium and supposed to be barite, chalcopyrite, and tennantite. In the same mine quartz veins containing native copper, probably formed from the oxidation of tennantite, have been found, and bornite occurs sporadically. In the Tissoff mine tennantite occasionally is found on seams in the pyrite.

The ore from the three productive mines is treated in blast-furnaces at Karabash, the process being practically pyrite smelting. The electrolytic refinery at Kyshtim, the only one in the Urals, refines the copper from the converters. The water from the Koniukhoff mine contains copper, which is precipitated on scrap-iron as cement copper.

TANALYK.—The Tanalyk property includes a number of old mines in schist and is situated in the south end of the Urals about 200 miles south of Miass, a station on Trans-Siberian railway. The geological formations in general are similar to those farther north; Devonian sedimentary rocks and various igneous rocks including serpentine. The ore varies in the different shafts. Usually it is silicious in character with fair copper and relatively high precious-metal contents. It contains barite and in some veins much zinc. The impregnated schist of the walls of the veins often contains enough gold, silver, and copper to form ore. The following analyses give an idea of the general nature of the ores:

| Average of two analyses Capital Shaft | | Average of 10 analyses Centre Shaft | |
|---|---|---|---|
| | % | | % |
| Cu | 3·13 | | 7·23 |
| Fe | 11·30 | | 18·04 |
| S | 21·30 | | 26·92 |
| Zn | 16·90 | | — |
| $SiO_2$ | 27·80 | | 7·89 |
| $BaSO_4$ | 1·80 | BaO | 15·98=24·33 $BaSO_4$ |
| $Al_2O_3$ | 11·20 | | — |
| CaO | 0·45 | | 8·88 |
| Insol. | — | | 23·91 |
| Au. oz. per ton | 0·60 | | 0·34 |
| Ag. oz. per ton | 2·75 | | 7·90 |

[1] H. H. Knox, Trans. Inst. Min. and Met., London, Vol. XVIII.

[2] Soft sulphides is a term now used at Kyshtim for pyrite valuable only for its sulphur contents. This pyrite contains very little gold, silver, or copper.

[3] A. M. Finlayson, 'Economic Geology,' Vol. V, p. 410.

PLAN OF THE PYRITE LENSES

OF THE

# ZUZELSK MINE.

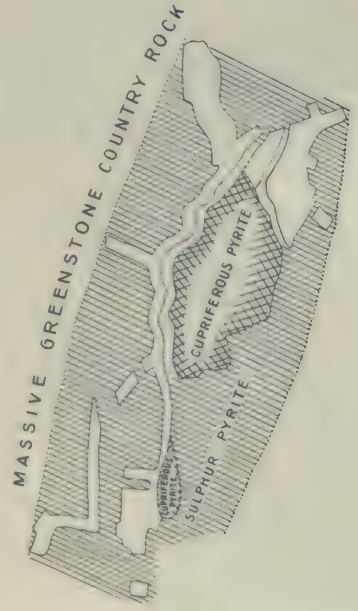
FROM DATA OF AUGUST HOFFMANN-FEB 1912

SCALE IN FEET

0 40 80 120 160 200 240

SULPHUR PYRITE

CUPRIFEROUS PYRITE

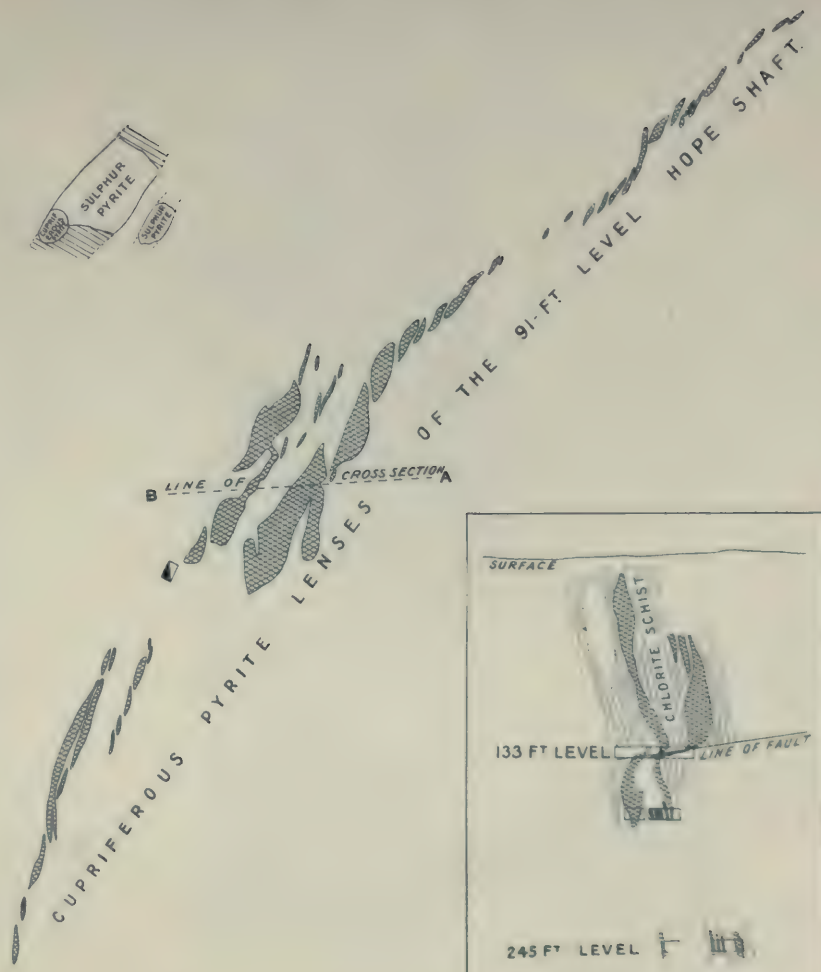


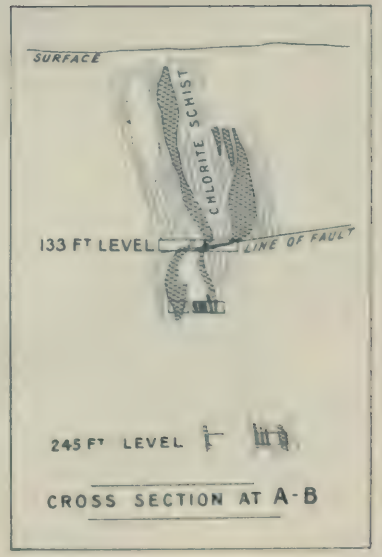

WORKINGS ON THE 68 FT LEVEL

OF THE

BIG LENS




CROSS SECTION AT A-B

ANALYSES OF URAL PYRITE ORES.

| | 1 Behlorechensk Pyrite | 2 Behlorechensk gossan | 3 Kalata pyrite | 4 Zuzelsk pit pyrite | 5 Zuzelsk impregnated schist | 6 Koniukhoff pyrite | 7 Tissoff pyrite | 8 Tissoff gossan |
|---|---|---|---|---|---|---|---|---|
| Cu | 1·41 | 0·12 | 2·05 | 6·28 | 5·97 | 3·43 | 3·40 | 0·12 |
| Fe | 45·50 | — | 42·10 | 44·02 | 31·53 | 41·85 | 37·55 | — |
| S | 48·10 | 0·20 | 44·90 | 47·05 | 32·00 | 49·85 | 44·36 | — |
| Zn | — | — | — | — | — | 1·73 | 1·40 | — |
| Pb | — | — | — | — | — | 0·12 | 0·44 | — |
| Mn | — | — | — | — | — | — | — | — |
| $Al_2O_3$ | — | 6·20 | — | 0·66 | 8·22 | 0·17 | 1·00 | — |
| Fe $O_3$ | — | 65·60 | 5·40 | — | — | — | — | — |
| $SiO_2$ | 1·50 | 17·10 | — | 1·55 | 20·36 | 0·49 | 3·00 | — |
| $BaSO_4$ | none | none | none | none | — | 1·34 | 5·41 | — |
| CaO | 0·60 | 1·00 | 0·50 | — | — | 0·27 | 0·82 | — |
| MgO | — | 0·10 | — | — | — | 0·26 | 0·59 | — |
| Se | present | — | present | — | — | — | — | — |
| As | — | — | — | — | — | 0·14 | 0·27 | — |
| $H_2O$ | — | — | — | — | — | — | — | — |
| O etc | — | — | — | — | — | 0·35 | 1·76 | — |
| Insol | 1·80 | — | 1·20 | — | — | — | — | — |
| Total | 98·91 | | 96·15 | | | 100·00 | 100.00 | |
| Au. oz. per long ton | 0·09 | 0·41 | 0·03 | —[1] | 0·62 | — | — | 0·07 |
| Ag. oz. per long ton | 1·50 | 0·50 | 0·40 | — | 0·70 | — | — | 3·10 |

— means not determined.
[1] This ore is said to contain about 10 shillings per long ton in gold.

No. 1 is a composite of 21 samples of the Behlorechensk pit ore on the Werkh-Issetsk estate taken in 1911 by H. G. Nichols.[1]

No. 2 is a composite of samples of the gossan of the Behlorechensk pit taken in 1911 by H. G. Nichols.

No. 3 is a composite of 25 samples of the Kalata pyrite taken in 1911 by H. G. Nichols.

No. 4 is an analysis of the copper ore of the pit at the Zuzelsk on the Syssert estate.

No. 5 is an analysis of the impregnated schist ore from the Hope shaft of the Zuzelsk mine. No. 4 and 5 were furnished by the courtesy of August Hoffmann.

No. 6 is an average of 12 analyses made in London of the cores of bores No. 3, 3a, and 4 of the Koniukhoff mine.

No. 7 is an analysis of the cores of bore No. 9 of the Tissoff mine. An older analysis of the Tissoff pyrite shows the presence of 0·37% manganese.

No. 8 is an incomplete analysis of the Tissoff gossan.

[1] The publication of the information concerning the Werkh-Issetsk and the Kyshtim mines is due to the courtesy of R. Gilman Brown and the Kyshtim Corporation.

## Production of Copper in the Ural Region.[1]

| Year | Poods |
|---|---|
| 1891 | 174,403 |
| 1892 | 183,713 |
| 1893 | 174,917 |
| 1894 | 144,805 |
| 1895 | 151,511 |
| 1896 | 167,574 |
| 1897 | 220,783 |
| 1898 | 236,863 |
| 1899 | 253,610 |
| 1900 | 241,148 |
| 1901 | 217,063 |
| 1902 | 279,135 |
| 1903 | 265,116 |
| 1904 | 265,915 |
| 1905 | 225,800 |
| 1906 | 288,600 |
| 1907 | 457,904 |
| 1908 | 522,584 |
| 1909 | 530,778 |
| 1910 | 644,039 |

Total for 20 years ..... 5,646,261 = 91,068 long tons

[1] Taken in part from *The Mineral Industry* for 1910.

The greater part of this copper was produced on the Bogoslovsk estate. Since 1910 probably the Kyshtim is the largest producer.

*A DRILLING PLANT AT KYSHTIM.*

*THE KARABASH SMELTER, OF THE KYSHTIM COMPANY.*

# CYANIDATION - AMALGAMATION

By T. A. RICKARD.

AMONG a variety of technical observations incidental to a recent journey to Northern Ontario, the most interesting is the metallurgical process in use at the so-called high-grade mill of the Nipissing mine. It is the plant in which is treated the picked ore taken from a celebrated mine at Cobalt. This ore, containing native silver and argentite, together with the arsenides of cobalt and nickel (6% Ni, 7 to 8% Co, 40% As) after being crushed to 70-mesh at the sampler is delivered to the plant with an average content of 2600 oz. silver per ton. It is fed to a Krupp tube-mill, 20 ft. long by 4 ft. diameter. The charge consists of 3½ tons of ore, 4½ tons of mercury, and a 5% cyanide solution. The tube-mill is closed at both ends. Air, to accelerate chemical action, is introduced through a pipe. There is also an ingenious device whereby the excess of air is subsequently expelled. After 9 hours in the tube-mill, 98% of the silver has been extracted from the ore, which, in the form of pulp, then passes to a settler, where the amalgam is separated by gravity. Thence it goes to a clean-up pan and drainers. These last are canvas bags for removing any excess of mercury. Meanwhile the pulp and solution, deprived of amalgam, passes to a vat and is fed to a Butters filter, the clarified solution going to boxes in which the dissolved silver is precipitated on zinc shaving. This shaving is in the form of a coarse wire, necessary on account of the strength of the cyanide solution. The residue, left on the filter, is stored, being valuable for its arsenic, nickel, and cobalt. As yet no method has been devised for eliminating the arsenic in this residue with a view to marketing the nickel and cobalt.

Meanwhile the amalgam, containing 80% mercury and 20% silver, is placed in retorts, each of which holds 450 lb. After the mercury has been distilled, the silver, still containing 1% mercury, is taken to a reverberatory furnace. Here it is melted in a charge of 25,000 ounces. After 15 hours exposure to a hot oxidizing atmosphere, without addition of any flux, the molten metal is cast in ingots, each weighing 1100 oz. silver, which is 999 fine. Two oil-burners afford the necessary heat. The flue from the furnace is provided with a water-jet condenser, whereby 1000 to 2000 lb. mercury is arrested monthly. The gases escape at 100°F. While I was collecting these data, a melt was about to be finished, and I was able to see the bath of molten metal before it was tapped into the rows of ingots. During February 550,000 ounces of silver were melted in this small plant.

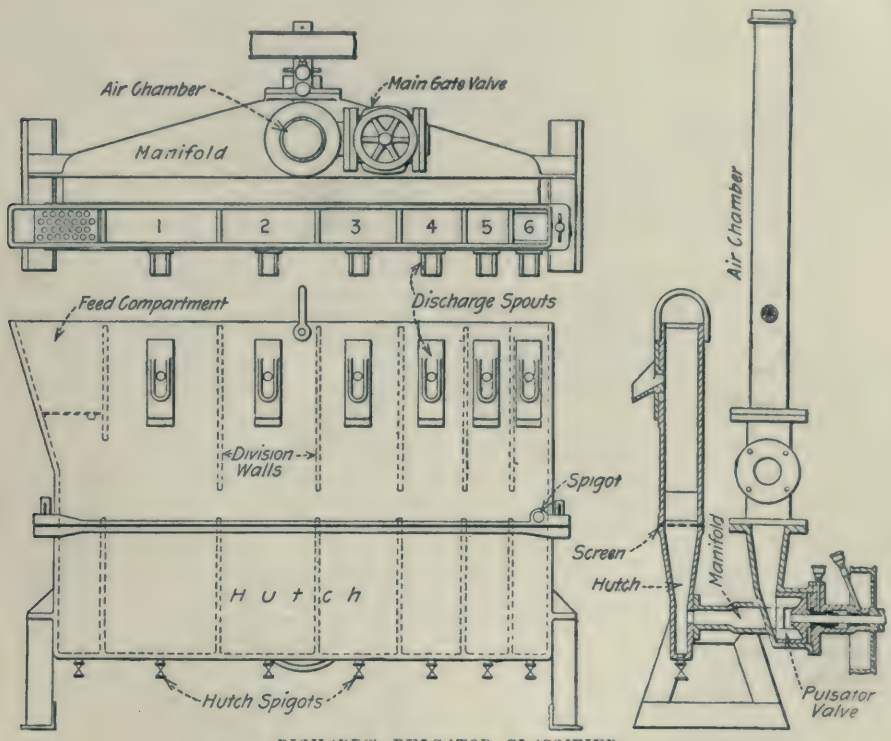
The richness of the mine product under treatment and the completeness of the metallurgical operations left a vivid impression. Within a small building it was possible to watch the successive stages by which a complex ore of a refractory type yielded its precious content in metal of such purity as to be ready for the mint. The entire process is so expeditious that the silver is delivered at New York within a week of the day when the ore is received at the mill and a cheque for the yield is received concurrently with the shipment. No less than 20 tons of mercury is in use at a given time. The cyanide has a cleansing action upon it; indeed, the use of mercury would be impracticable without the cyanide, for the mercury would become 'sick' or fouled, so as to hinder amalgamation with the silver in the finely-ground arsenical ore. The yoking of cyanidation and amalgamation constitutes another remarkable feature. To the practical man, however, the most memorable note is the fact that a consignment of ore is turned into negotiable paper within seven days. It remains to add that Charles Butters devised the process and that James Johnston designed the plant for the Nipissing Mines Company.

It is planned to erect a mill, embodying a similar process, for the treatment of the dumps, which contain 80,000 tons of ore assaying 22 ounces silver per ton. The picked stuff will go to the mill above described and the remainder to 40 stamps, 4 tube-mills, a Butters filter, a Merrill press, with smelting of the precipitate in a small blast-furnace.

While at Cobalt I also paid a short visit to the Northern Customs concentrator. This contains 70 ordinary and 4 Nissen stamps, crushing daily 270 tons of silver ore through 16-mesh screens. There is no regrinding. From the battery the pulp passes to classifiers. The sand is treated on two sets of Wilfley tables, the middling passes to classifiers and corrugated-belt vanners, the slime goes to Callow tanks with overflow to buddles and canvas inclines.

# PRÉCIS OF TECHNOLOGY

**Richards' Pulsator Classifier.**—This machine, introduced by R. H. Richards, of Boston, a few years ago, for classifying crushed ore into different grades suitable for concentration on various tables, has recently been substantially improved in construction and design. The objection formerly urged against it was that there were far too many adjustments. In the new form most of these adjustments have been eliminated, and it is claimed that none are now necessary; also that it will work as well at one tenth as well as at full capacity, and that it adapts itself automatically to sudden changes in the rate of feed. The *Engineering and Mining Journal* for May 4 describes and illustrates this latest form. As is already well known, the classifier acts on the principle of carrying the ore upward by means of ascending columns of water through which a pulsating movement is transmitted, the various columns moving upward at different rates and carrying with them different grades of material. Referring to the illustration, the hydraulic water enters by the main gate valve at a head of 20 ft., and passes through the pulsator valve which gives it the pulsating motion. From thence it is distributed by a manifold to near the bottom of the chambers (*1*), (*2*), (*3*), (*4*), (*5*), (*6*). The division walls between these compartments are not continuous, but have central openings measuring 4 in. high at about the middle, and at the bottom of the openings a screen extends the whole length of the 6 divisions. The chambers are of varying width, and the hydraulic water rises through them at rates varying inversely with the width. The ore-pulp is fed at the end adjacent to the widest compartment, and as it passes along the screen, the slowly ascending water carries up the slime which is discharged from the spout at the top. As the ore passes along the screen into the succeeding compartments, the quicker upward currents of water carry away coarser material, and any large or heavy particles that will not rise in No. 6 compartment are removed through a spigot at the end of the screen. Below each chamber are hutches to catch any heavy particles that work their way down, but with care comparatively little material will reach the hutches. This machine does not occupy much space. One with a capacity of 170 tons per day occupies a floor-space measuring 3 by 5 ft. and weighs only 1600 lb.




*RICHARDS' PULSATOR CLASSIFIER.*

**Rand Ore-Reserves.**—The *South African Mining Journal* for April 13 gives its usual annual review of the ore reserves throughout the Rand, prefacing the article by a protest against the want of uniformity in the method of making the returns. For instance, some reports are made in terms of the tonnage to be mined, and others in terms of the tonnage that will be milled after the removal of waste. Also there is confusion in many cases as to how much of the reserve is locked-up in pillars and arches and whether this is ultimately recoverable or not. Then again the border line of profitableness or otherwise is difficult to draw. In our contemporary's figures, only fully developed and fully valued ore is included in the estimate, except in a few cases where this rule may be broken with little fear of error. The figures in mining tons are given according to groups in the tables on the succeeding page. The number of mines not belonging to the groups is unimportant, and their reserves are not quoted.

| | Tons |
|---|---|
| Central Mining and Investment | 36,999,442 |
| Companies with head offices in Natal managed by the above | 1,358,800 |
| Consolidated Gold Fields | 9,199,000 |
| East Rand Proprietary (Farrar) | 6,716,605 |
| Anglo-French Group | 1,753,370 |
| General Mining and Finance | 5,842,556 |
| S. Neumann & Co. | 4,183,962 |
| Johannesburg Consolidated | 5,814,231 |
| Randfontein-Langlaagte (Robinson) | 6,940,166 |
| A. Goerz & Co. | 1,949,207 |
| Consolidated Mines Selection | 1,925,346 |
| Total Proved Ore | 82,682,685 |

In addition, our contemporary considers it safe to include some of the probable ore, and thus obtains a figure slightly over 100,000,000 tons. As the yearly output is about 25,000,000 tons, it is seen that the reserves are sufficient for 4 years work. As regards the total recoverable content, this is estimated at £140,000,000, but it is impossible to predict the eventual profit to be derived therefrom by the shareholders owing to the uncertainty of legislation and of the labour supply. In the following tables are given the reserves on December 31 last of individual members of the groups :

CENTRAL MINING AND INVESTMENT :

| | Tons. | Dwt. per ton. |
|---|---|---|
| Bantjes Consolidated | 896,087 | 7·3 |
| City Deep | 2,078,805 | 8·1 |
| Crown Mines | 10,124,072 | 7·25 |
| Durban Roodepoort Deep | 1,288,071 | 6·8 |
| Ferreira | 324,603 | 8·13 |
| Ferreira Deep | 1,837,808 | 9·7 |
| Geldenhuis Deep | 2,262,840 | 6·2 |
| Modderfontein B | 2,355,700 | 7·5 |
| New Modderfontein | 3,341,830 | 7·6 |
| Nourse Mines | 2,050,705 | 6·6 |
| Robinson 1,221,661 | — | 11·4 |
| 305,000* | — | — |
| 1,307,133 | — | 4·2 |
| | 2,833,794 | |
| Rose Deep | 3,670,160 | 6·0 |
| Village Deep | 2,159,792 | 6·1 |
| Village Main Reef | 1,775,175 | 9·2 |
| Total | 36,999,442 | |

* Estimated tonnage recoverable from old workings, etc.

COMPANIES WITH HEAD OFFICES IN NATAL, MANAGED BY THE CENTRAL MINING AND INVESTMENT CORPORATION :

| | | |
|---|---|---|
| City and Suburban | 789,084 | 7·6 |
| New Heriot | 569,716 | 8·4 |
| Total | 1,358,800 | |

CONSOLIDATED GOLD FIELDS :

| | | |
|---|---|---|
| Jupiter | 1,089,000 | 5·74 |
| Knights Deep | 1,650,000 | 5·2 |
| Luipaardsvlei Estate | 432,000 | 5·2 |
| | 142,000* | 5·3 |
| Robinson Deep | 1,140,000 | 7·2 |
| Simmer Deep | 1,312,000 | 4·9 |
| Simmer and Jack | 2,500,000 | 6·4 |
| Simmer and Jack East | 934,000 | 5·4 |
| Total | 9,199,000 | |

* Partly developed.

FARRAR GROUP :

| | | |
|---|---|---|
| East Rand Proprietary | 6,716,605 | 6·9 |

ANGLO-FRENCH GROUP :

| | | |
|---|---|---|
| Benoni Consolidated | 606,839 | 6·56 |
| New Kleinfontein | 1,146,531 | 7·49 |
| Total | 1,753,370 | |

GENERAL MINING AND FINANCE :

| | | |
|---|---|---|
| Aurora West | 345,578 | 5·85 |
| Cinderella Consolidated | 740,157 | 6·73 |
| Van Ryn | 1,655,910 | 6·37 |
| Meyer and Charlton | 312,336 | 10·099 |
| New Goch | 962,575 | 5·06 |
| Rand Collieries | 374,200 | 5·375 |
| Roodepoort United | 448,800 | 5·49 |
| West Rand Consolidated | 1,003,000 | 5·25 |
| Total | 5,842,556 | |

S. NEUMANN & CO. :

| | | |
|---|---|---|
| Consolidated Main Reef | 516,100 | 6·7 |
| Knight Central | 644,300 | 6·04 |
| Main Reef West | 628,260 | 7·0 |
| Vogelstruis Cons. Deep | 149,530 | 5·9 |
| Witwatersrand Deep | 1,436,202 | 6·79 |
| Wolhuter | 808,780 | 6·45 |
| Total | 4,183,962 | |

JOHANNESBURG CONSOLIDATED :

| | | |
|---|---|---|
| Consolidated Langlaagte | 1,619,647 | 6·7 |
| Ginsberg | 367,646 | 6·8 |
| Glencairn | 925,000 | 3·5 |
| New Primrose | 423,311 | 6·7 |
| New Rietfontein | 361,484 | 6·1 |
| New Unified | 288,343 | 6·73 |
| Van Ryn Deep | 603,716 | 7·17 |
| Witwatersrand | 1,225,084 | 5·65 |
| Total | 5,814,231 | |

RANDFONTEIN-LANGLAAGTE GROUP :

| | | |
|---|---|---|
| Langlaagte Estate | 1,281,307 | — |
| Randfontein Central | 5,658,859 | 7·24 |
| Total | 6,940,166 | |

A GOERZ & CO. :

| | | |
|---|---|---|
| Geduld Proprietary | 607,300 | 8·18 |
| Lancaster West | 472,700 | 6·65 |
| May Consolidated | 212,707 | 6·84 |
| Princess Estate | 656,500 | 7·26 |
| Total | 1,949,207 | |

CONSOLIDATED MINES SELECTION :

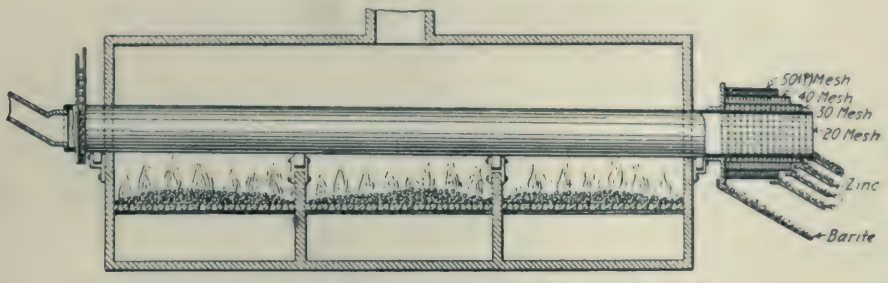
| | | |
|---|---|---|
| Brakpan Mines | 1,925,346 | 6·73 |

**Synthesis of Iron Sulphides.**—In the *American Journal of Science* for March, E. T. Allen, J. L. Crenshaw, and J. Johnson elaborate a theory of the formation of pyrite and other sulphides of iron. They discard the theory that the disulphides, pyrite and marcasite, have been formed by the action of carbonaceous matter on ferrous sulphate solutions, and show that all their experiments on these lines have failed to reproduce the reactions. On the other hand their experiments with sulphuretted hydrogen under certain conditions have proved successful. When ferric sulphate is exposed to the action of sulphuretted hydrogen, the result, as is well known, is the production of ferrous sulphate, sulphuric acid, and sulphur. If subsequently this reaction is continued in a closed vessel

where the sulphuretted hydrogen cannot oxidize or escape, the authors find that a second reaction between the ferrous sulphate and sulphuretted hydrogen takes place, producing disulphide of iron and sulphuric acid. The authors also discovered that the degree of concentration of the liberated sulphuric acid and the temperature had an effect in determining whether the disulphide would assume the form of pyrite or marcasite. Experiments with freshly precipitated ferric hydroxide showed that it is immediately blackened by sulphuretted hydrogen, the deposit consisting of a mixture of ferrous sulphide and sulphur. This deposit was then treated further with a saturated solution of sulphuretted hydrogen in a sealed vessel, heated to 140° C for several days, and was subsequently found on examination to have a yellow-grey colour, and to consist of disulphide. The authors proceed to describe experiments on the reactions with pyrrhotite, and on the transformations between pyrite and marcasite. The paper is a lengthy one and enters into great detail.

**Separating Barite from Blende.**—In the Missouri zinc district there are extensive deposits of low-grade blende ores that contain much barite, and owing to the impossibility of separating these two minerals by water concentration the deposits have not so far been touched. Presumably flotation methods have not been tried. In the *Engineering and Mining Journal* for May 11, F. C. Bryant describes a process of treatment that is giving satisfactory results. This consists of exposing the concentrate to a low heat not sufficient to roast the blende, but enough to make the barite decrepitate. This characteristic of barite falling to a fine powder on heating while the blende is not comminuted to so great a degree, provides an effective method of separating the two by screening. The concentrate is passed through a rotating tube and the discharge is passed through screens. The accompanying illustration shows the idea diagrammatically. At the Tahoma mine, where the process was evolved, the separator-tube is 12 ft. long and 8 in. diam., set in a brick furnace. The concentrate from the jigs is fed through a loose-ring hopper, and at the discharge end there are screens of 20, 30, and 40 or 50 mesh. It is found that the whole of the barite is reduced to a fineness less than 40 or 50 mesh, and in fact 90% of it will pass 200 mesh. Only about 10% of the blende passes the 40 or 50 mesh screen along with the barite, and this is removed from the barite by wet separation on 200-mesh screens. The clean barite recovered in this way sells for $5 per ton, which is ample to cover the cost of the separation. The author mentions that of twenty ores tried, one failed to give results, owing to the barite refusing to decrepitate and fall to powder. The physical conditions involved are therefore not fully clear, and the applicability of the process can only be judged by tests.

**Platinum and Gold in Russia.**—At the May meeting of the Institution of Mining and Metallurgy, Leon Perret presented a lengthy and detailed paper on the platinum and gold alluvial deposits in Russia. In contrast to the usual history of gold mining, the veins were worked in Russia before the gravel deposits. The first mine was the Voitsky, in the Government of Archangel; this contained a quartz vein in micaceous schist, chalcopyrite being present as well as gold. Operations were continued from 1732 to 1794. In 1745 gold gravel was found at Berezovka on the eastern slope of the Ural range, but it was not worked. Shortly after, in 1752, quartz lodes were found in the same region, and ever since, gold mining has been conducted in the Ural mountains. The first alluvial operations were started in 1814 on the deposits discovered in 1745. Platinum was first found in 1819 during the mining of the gold placers on the Verkhissetsk Estate, but for a long time nobody knew what it was. When, four years later, Liubarsky and Humboldt had identified it, operations were started along the river Iss on the Goroblagodatsk Estates in the Perm province. The government adopted platinum for coinage purposes and commenced the issue of coins in 1828, at the same time




*FURNACE FOR SEPARATING BARITE FROM BLENDE.*

making the trade in the metal a state monopoly. This condition of things greatly stimulated the industry of platinum mining. Subsequently in 1845 the Russian monetary system was altered by the adoption of paper money, and the issue of platinum coins was gradually dropped. By 1856 the industry was entirely dependent on foreign purchases. For a long time after, the demand, price, and output were very low, but subsequently to 1870 the demand began gradually to grow again.

The method of prospecting in use in Russian gold and platinum deposits is to place pits or bore-holes in straight lines across the deposits, and naturally the decision as to the right direction of these lines requires the exercise of much judgment and experience, otherwise the richer parts may never be found. In regions where there is little snow in winter, such as in the Amur province and the eastern side of Lake Baikal, 'frost prospecting' is largely employed. According to this method, pits are sunk to the water level before the arrival of winter. After a week or ten days of frost, the sides and bottom of the pit are frozen for 2 or 3 ft. in all directions. Then small piles of wood are kindled at the bottom, and the ground thawed for a foot or so. The loosened gravel is removed and the ground allowed to freeze again. Thus by alternate freezing and thawing the pit is sunk to bedrock. The pits are generally 6 ft. square or thereabouts. The earth removed at each thawing is kept separate, and washed to determine the metal content at the varying depths. The author discusses the applications and variations of this pro-

cess adapted to circumstances, and gives full practical details of this and other methods of mining.

With regard to other practice, the author expresses his belief that prospecting by machine drilling is not so suitable as the manual labour and pits, in Russia and Siberia, owing to the heavy overburden and the large size and hardness of the boulders. He mentions a method of preventing ditches from freezing, that has stood the test of practice. In the autumn the level of the water in the main race is raised just before the frosts start, by placing extra boards against the dam; then when ice has formed for 2 in. or so, the boards are withdrawn, and an air space is left between the ice and the water, that effectively prevents the water from freezing subsequently.

**Geology for Prospectors.** — In the *Mining and Scientific Press* for May 4, C. A. Stewart contributes an article reviewing the applications of geological science to the examination and determination of surface showings. Most of the larger mining companies employ staffs of geologists to record the results of development, and many smaller companies requisition the services of a consultant as occasion requires. The author considers that the advice of a skilled geologist would be of even greater service before the actual operations are commenced, and he therefore urges that the results of prospecting work should be examined from the scientific standpoint. For the benefit of the prospector he details the deductions that may be made from surface showings. Though ore deposits vary widely in character, it is possible to refer nearly all to four types: (*1*) fissure veins, (*2*) contact metamorphic deposits, (*3*) irregular replacements other than contact metamorphic deposits, and (*4*) impregnations.

Fissure veins are of wide-spread occurrence, and for this reason many deposits are worked on the supposition that they belong to this class, often to the disappointment of those interested. In true vein deposits it is important to distinguish between those which are the result of filling open fissures and those which are the result of replacement of the wall-rocks along narrow cracks which themselves would not be wide enough to furnish workable orebodies. The changes which may be expected when a vein of the first type (open-fissure filling) passes from one rock formation to another are those dependent upon the kind of resistance the different rocks offer to forces of fissuring. Homogeneous rocks, like the igneous rocks and massively-bedded sediments, are likely to give wide, well-defined fissures; shaly and schistose rocks, on the other hand, often cause the fissure to split into small cracks, so that an orebody that is a sharply defined vein in a granite or a sandstone may change to a mass of small stringers on passing into a shale, schist, or slate, and the reverse. Veins of the second class (replacement veins) generally vary in width with the solubility of the wall-rock. Such veins may be mere stringers in granite or quartzite and widen out into rich bonanzas where they cut more soluble rocks, such as limestone. Igneous rocks with an abundance of the dark silicates (hornblende, augite, and biotite) are more favourable to replacement than the light-coloured granites. The two processes of vein formation may have been at work in different parts of the same vein, while in other cases no replacement may be shown, and the vein may be a true fissure filling throughout, with a value depending entirely upon the size of the original crevice. For this reason, no man, no matter how expert a geologist, can absolutely predict the action of veins with depth.

Contact-metamorphic deposits are found at the contact of igneous and sedimentary rocks, and have as gangue-minerals garnet, epidote, pyroxene, wollastonite, and other contact-metamorphic silicates. Their position and characteristic gangue-minerals make them easily recognizable, but because their outcrops are sometimes linear in extent, they may be mistaken for veins, and serious mistakes in exploration may thus result. Contact-metamorphic ores are usually irregular in shape; bunches, pockets, and lenticular masses from a few feet to many hundreds of feet in dimensions. They usually hold close to the contact, and follow its numerous windings. Limestone is the most favourable country rock. A careful study of deposits of this class makes necessary a subdivision into two classes, which act differently. Thorough exploration of these ores must be based upon a geological map that will show the igneous-sedimentary contact, and the position of the several sediments. To make such a map is often a difficult matter, for excessive metamorphism in the district may produce rocks that are hard to classify.

Under the third head are included orebodies not apparently related to fissures or to igneous contacts, and formed by replacement of the wall-rocks. The deposits of Leadville are among the most famous of this class. The ores may show all the irregularities of the contact-metamorphic ores and present greater difficulties to exploration because there is no contact line to serve as a guide. Their shape and location is, however, usually dependent upon some geologic structure that a careful study will make clear. Replacement bodies are often found along lines of fracture that because of insignificant size and lack of ore pass unnoticed. When such a condition is recognized, it is possible to locate these lines of fracture, and to conduct underground exploration along them with good results. At other times the replacement occurs along the contact of the ore-bearing formation and an impervious rock, which has dammed up the ore solutions and thus caused them to deposit their minerals. In general, limestones are the rocks most often containing replacement deposits, but certain beds, either because of greater porosity or greater purity, may be more favourable than others of the same formation.

Impregnations or disseminated deposits are those in which ore occurs in minute quantities scattered throughout great masses of rock. In this class are the 'porphyry coppers' that have attracted such great attention at Bingham, Utah; Ely, Nevada; in Arizona; and New Mexico. These ores are usually of value only when secondary enrichment has taken place. In the case of the copper ores at the surface, a capping of leached and more or less decomposed rock is found that may extend from fifty to several hundred feet in depth. Underneath this is a zone of secondary enriched ore that gives place to poor, usually unworkable, sulphides. Even the richest part of these ores is usually so lean that it must be worked on a large scale. The function of the geologist in these cases is to look for zones of fissuring that may have influenced the concentration of the ore, or that may affect mining, and to keep track of changes in depth and shape of the secondary zone, and to predict from these what may reasonably be expected in the future.

Among other types of ore that act in characteristic ways are magmatic segregations, bedded deposits, and lenticular deposits in schists and gneisses, but the author does not enlarge on these. He then proceeds to describe the features of secondary enrichment.

An understanding of the relative age of the ore deposits and the igneous rocks is sometimes of importance, and may be deduced in an indirect way, as is illustrated by the following case. In the case supposed

the ore veins occur in a series of sediments that are cut by dikes and sheets of diabase, and also by stocks of granite. The question at once arises as to the chance of the veins extending through the diabase. Comparison with neighbouring districts shows that the mineralization is most probably the result of the granite intrusion, and examination of the district itself establishes the fact that the diabase cuts the granite and is distinctly younger than it. The diabase intrusions, therefore, may be expected to cut the veins, and not be cut by them, and claims underlain by great masses of diabase are less promising than those in which sediments predominate. In Arizona most of the important copper deposits are connected with post-Paleozoic granites, and it is therefore reasonable to expect all formations younger than these granites to be found to be barren.

The value of geology in solving fault problems when the ore is cut off is well known, but it is customary to wait until the fault is intersected in the underground workings before paying any attention to it. In many cases a few days study of the surface geology will show the existence of faults, which from their strike and dip are likely to intersect and displace the orebody. With this in mind, the exploratory work can often be more wisely directed, and the discouragement of finding the ore unexpectedly cut-off avoided.

**'Ozonair' Ventilation.**—The *Colliery Guardian* for May 24 contains an account of the new ventilation apparatus installed on the Central London railway. The circumstances and conditions are similar in some ways to those in mine workings. Our contemporary and ourselves may be considered as a little in advance of our time in drawing attention to this apparatus, but as mine ventilation is receiving rapidly increasing attention there is good reason for studying every proposition. The Central London railway, commonly called the 'tube,' is 7 miles long, with 13 stations, and is from 60 to 100 ft. below the surface. There are two lines, each contained in a tube 11 ft. 8 in. diameter, and at intervals connected by cross-overs. Hitherto the ventilation has been effected by the passage of the trains and by an exhaust fan near the British Museum; and in the night hours during which no trains run, by an exhaust fan at the western end at Shepherd's Bush. In spite of all these precautions, the atmosphere was depressing and unpleasant, but as usual the cause is difficult to analyse. It is held generally to be the result of organic constituents of the air due to the continuous passage of large numbers of people. The company therefore decided to adopted the 'Ozonair' apparatus for introducing sterilized air containing a small proportion of ozone to give it oxidizing effect. At twelve of the stations independent apparatus has been provided. The air supply is first filtered in the usual way, and then passed between fine metallic gauze and mica sheets across which discharges are caused to pass by means of a 5000-volt alternating current. The current of air passed through averages 6000 cubic feet per minute at 10 of the stations, and 10,000 and 18,000 respectively at the other two. The air is sent along mains having a cross-section of about 3 sq. ft., made of galvanized mild steel, the shape of the section depending on the space available. Some of the air is discharged at five or six points along each platform and 7 ft. above them, and the remainder in the tunnels about 40 ft. from the station in the direction the trains run, to be drawn along by the trains to the succeeding station. Ozonair apparatus has been successfully employed in deodorizing and bleaching processes, and for improving the air in hospitals and workshops.

**Cone Classifier.**—In the *Mining and Scientific Press* for April 20, Douglas Waterman describes an improved form of cone-classifier that was developed at the San Sebastian mine in Salvador, belonging to the Butters Salvador Company. It proved so successful that the type is now adopted at all Butters plants. The ideal efficiency of a cone classifier is attained when the overflow is free from sand. The volume and specific gravity of the pulp determine the size of the cone. It is desirable, in order to save head room, to have the cone as small as possible. Fig. 1 shows the usual form of cone, with a central cylindrical intake and peripheral overflow. Two factors operate to prevent the quiet settlement of the sand. One is the diminished sectional area where the pulp enters the cone, and the other the rapid rise of imprisoned air bubbles. A simple device, which permits of a great reduction in the size of the cone, was introduced by W. G. Mosher at the San Sebastian mine. This device has more than doubled the capacity of the cone. The improved cone is shown in Fig. 2. The pulp flows directly into the cone, rises through the central cylinder, and overflows by means of a spout attached thereto. The stream enters the cone at the point of greatest area, where the force of the current is readily dissipated. The rising current in the cylinder is of low velocity and entirely free from air bubbles. The cylinder is divided by a partition extending to near the point of the cone. This prevents the vortex which would otherwise be formed by the discharge of the spigot. The annular space between the side of the cone and the cylinder is $\frac{1}{2}$ to $\frac{5}{8}$ inch.

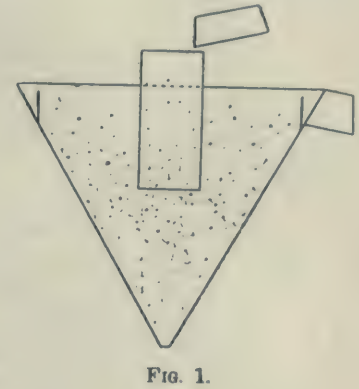


FIG. 1.

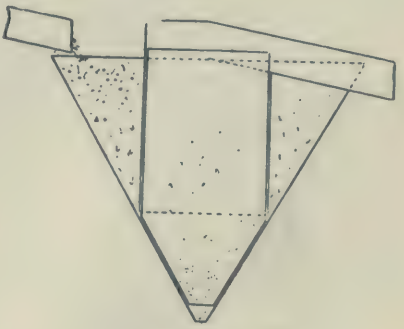


FIG. 2.

**Water Power in Scotland.**—The *Iron and Coal Trades Review* for May 24 quotes a paper read by Alexander Newlands before the Inverness Scientific Society entitled 'Our Sources of Power, with particular reference to Highland Water Power.' This paper contains valuable information as to the resources of north Scotland as regards hydro-electric power. In the general discussion of the water-power problem, it is often supposed that Great Britain cuts no figure at all, but this is a mistake. At the present time there are only three hydro-electric stations, two in Scotland at Foyers and Kinlochleven respectively, both belonging to the British Aluminium Company, and one at Snowdon in Wales where power is generated for the slate quarries. There was some intention to utilize the large mountain lakes east of Snowdon, but these schemes appear to be in abeyance. The mountains of Derbyshire and Yorkshire provide extensive catchment basins, but these are mostly required for the water-supply of towns. Mr. Newlands points out that the north and west of Scotland has the greatest extent of elevated area of any part of Great Britain, and a steady rainfall that is fairly uniform throughout the year. There are also a great number of mountain lochs or lakes, the discharge to the indented seaboard being steep and rapid. There are no glaciers or exceptional spring floods from frozen snow. The rainfall in many parts is over 60 inches per year, and 42 inches is taken by the author as a safe figure over the whole region. About two-thirds of this amount may be considered available for power. The author from personal knowledge has mapped out various districts where the rainfall and the catchment basins can be accurately estimated, and he has marked them on the accompanying map in terms of the horse-power available. The largest of these is estimated at 20,000 horse-power and the total is nearly 200,000 horse-power. These of course do not include that at Kinlochleven rated at 30,000 hp. or that at Foyers with 7000 hp. The drainage area at Kinlochleven is 55 square miles, and the water is unpounded by a dam 1037 yards long and with a maximum height of 86 ft. The overflow sill is 1065 ft. above sea level. The rainfall is 70 in. per year. The reservoir is 7½ miles long by ½ mile wide, and the capacity is 20 thousand million gallons. The author gives particulars of a possible utilization of the waters at Loch Luichart which could supply power and light to Inverness. A perusal of Mr. Newlands' paper makes it clear that the north of Scotland has a future as regards hydro-electric power. Other engineers have put the possible Scottish water-power at a million horse-power and Mr. Newlands is inclined to take these figures as reasonable, though he only vouches for the districts with which he is personally acquainted.

**Potash from Seaweed.**—This magazine has recently contained many references to the growing demand for potash salts for agricultural purposes. American engineers are devoting attention to the possibility of obtaining soluble salts from leucite rock, and the saline deposits of Southern California are being explored for potash salts. For several decades the Stassfurt deposits in Germany have provided the bulk of the commercial article, namely kainite, which is a compound salt of potassium chloride and magnesium sulphate. The imports of this article into the United States have been considerable, and the imposition of an export duty by Germany greatly upset the American trade. In Norway and Japan the old kelp industry is being revived for the same purpose. In this connection an article on the subject in the *Times* Engineering Supplement for May 29 will be read with special interest. Until the invention of the Leblanc process for the manufacture of alkali from common salt about a hundred years ago, practically the whole of the alkali and alkaline salts used in Europe were derived from kelp, that is, burnt seaweed. Along the western coasts of Ireland and northern Scotland, and also in Normandy, the Celtic population was actively engaged in its manufacture. The Gulf Stream continually carries great quantities of the marine vegetation to these neighbourhoods, and its collection is a simple matter. The amount of valuable salts is larger in the deep-sea vegetation than in the weed that grows in the shallower waters round the coast, so that attention was usually confined to the ocean drift. Unfortunately the methods of treatment were not altered to keep pace with scientific requirements, and the industry gradually shrunk to nothing. There is no reason why it should not be revived, for the scientific treatment for the extraction and separation of the salts is not really troublesome or complicated. The kelp prepared in Scotland averaged 23% potassium chloride, 7% potassium sulphate, 17% sodium chloride, and 4% of sodium and potas-

sium carbonates, together with 45% of insoluble matter. It is probable that some other process might be adopted instead of the old-fashioned burning; maceration and retorting have both been suggested and tried on a small scale. Seaweed also contains iodine salts, and the production therefrom of iodine is at present the only commercial application of this branch of the vegetable kingdom.

# CURRENT LITERATURE.

**Dry-Walling in Michigan.**—The *Engineering and Mining Journal* for April 27 and May 4 contains an article on the methods of mining at the Baltic copper mine, Michigan, the details of the dry-walling system being of particular interest.

**Concentrating Pyritic Blende.**—At the May meeting of the Institution of Mining and Metallurgy, E. C. Hugon described the plant recently erected at the Pierrefitte mines, in the French Pyrenees, intended for treating the blende-pyrite concentrate. This material is given a roast to magnetize the pyrite, which is then removed by a dry magnetic separator.

**Cyaniding Concentrate.**—In the *Engineering and Mining Journal* for April 27, E. M. Hamilton reviews the circumstances governing the decision as to the best way of dealing with the sulphides in gold ores.

**Sodium Sulphide as a Precipitant.**—In the *Engineering and Mining Journal* for May 18, E. H. Webster gives reminiscences of practice in connection with the precipitation of silver as sulphide fron cyanide solutions by the action of sodium sulphide. The communication was prompted by suggestions made by E. M. Hamilton in the article mentioned in the above paragraph.

**Sintering Iron Ores.**—The May *Bulletin* of the American Institute of Mining Engineers contains a number of articles on sintering iron ores and flue-dust: Sintering by the Dwight-Lloyd Process, by B. G. Klugh; Agglomeration of Fine Material, by W. S. Landis; Sintering and Briquetting of Flue-Dust, by F. A. Vogel; Schumacher Briquetting Process, by J. W. Richards; Briquetting of Iron Ores, by N. V. Hansell.

**Selling Copper.**—In the *Engineering and Mining Journal* for May 4 and 11, W. R. Ingalls describes the current methods of marketing copper.

**Porcupine.**—The *Canadian Mining Journal* for May 1 contains a full translation of the article by W. Baelz that appeared in *Zeitschrift fur Praktische Geologie* for November 1911 on the geology of Porcupine.

**Porcupine Mines and Ores.**—The *Engineering and Mining Journal* for May 4 contains an article by Reginald E. Hore describing the mines and ores of Porcupine, Canada.

**Tin Deposits.**—In *Economic Geology* for May, H. G. Ferguson and A. M. Bateman review from a scientific standpoint some of the published information about the geology of tin deposits, and J. T. Singewald, jr., contributes a paper on 'Some Genetic Relations of Tin Deposits.'

**Nathusius Electric Furnace.**—At the May meeting of the Iron and Steel Institute, H. Nathusius described his electric furnace designed for the manufacture of steel

**Ancient Iron.**—At the May meeting of the Iron and Steel Institute a number of papers were presented describing ancient specimens of iron: Iron and Steel of Ancient Origin in Ceylon, by Sir R. A. Hadfield; Early Use of Iron in India, by H. G. Graves; Early Iron in Staffordshire, by T. Turner; Roman Bloom of Iron found at Corbridge, by Sir Hugh Bell.

**Potash in California.**—In the *Engineering and Mining Journal* for May 18, W. D. Hamman writes of the Searle Lake basin in San Bernadino county, California, where 'potash' has been found in solution below the crusts of common salt, carbonate and sulphate of soda, and borax. The author describes the occurrence in great detail, but does not say which salt of potash is found.

# BOOKS REVIEWED

THE SHADOW SHOW. By J. H. Curle. Cloth, octavo, 380 pages. London: Methuen & Co. Price 5s. For sale by *The Mining Magazine*.

The author of this book is well and honourably known as an outspoken and virile commentator on mining affairs, although his name has not been as prominent in mining periodicals as it was formerly when he was Special Commissioner to *The Economist* and Special Contributor to the *Mining and Scientific Press*. The reason is now made known. The author of 'The Gold Mines of the World' was writing 'The Shadow Show.' If style be the man, then this book is Mr. J. H. Curle. It is a frank and brutal expression of his views on things in general as the result of many years of world-wide travel and close observation. To those who know him, it is the man himself. He writes as he talks, vividly, recklessly, and always interestingly, from a shadowy background of sunless thought and sombre philosophy. The first chapter is autobiographical, and explains the conditions that moulded his youth. The second is a sequel dealing mainly with his early experience in South Africa. The third tells of the part he played in the inglorious days of the Jameson raid, and the financial filibusters; this chapter throws a valuable side-light on an episode the humour of which Mr. Curle fully understood. The fourth deals with mining speculation; it ought to be longer, but, even as it is, it contains several frank statements quite in line with the author's previous utterances on a subject concerning which he is an admitted authority. The latter half of the chapter is an appraisal not of mines but of men, as national types. The next chapter is devoted to women. For this we care not at all; it is given to few men to analyse and dissect the character of women in a manner commending itself to other men—or to other women, especially. Chapters VI. and VII. are devoted to glimpses of the East and impressions of parts of Asia but little known to the ordinary traveller. A keen appreciation of natural beauty is here blended with an intellectual impressionism that varies from the bizarre to the profound. The South American chapter is excellent; it is a vivid and sketchy description of countries where many a prospect often pleases and man alone is frequently vile. The author indulges in occasional witticisms, some of which are undeniably clever. On the front of the law-courts at Manaos, where justice is sold cheaply, there is inscribed LEX. A Brazilian informs Mr. Curle: "That's Latin." He answers: "Yes, I know. The Law and the Profits." Several pages are devoted to Stevenson and his grave in Samoa. Other chapters remain, unlike in their subject matter and treatment. That entitled 'Mine Own People' is a proud and patriotic appraisal of England's position, of her performance as a nation in India and Egypt, of her weakness and strength, of her danger and her destiny. Here we find the author at his best as a man of the world, as an observant and outspoken critic. The luxury and parasitic habits that weaken the character and strength of a great people are attacked forcefully.

International politics and world movements are discussed by a man of the widest information. Surely he is entitled to exclaim : "I know our Empire. I know it from Dawson to Stanley, from Nassau to Cooktown, from Bay of Islands to Hokitika, from Srinagar to Bhamo, from Kowloon, Kwala Lipis, and Khama's town to Kumasi and Khartoum. I claim to speak as one who has seen."

T. A. R.

PROSPECTING FOR MINERALS. By S. Herbert Cox. Cloth octavo, 260 pages, with illustrations. London : Charles Griffin & Co. Price 5s. For sale by *The Mining Magazine*.

The first edition of this book was published in 1898, and several reprints have been issued since. The present is the 6th edition, and it contains additional information together with some rearrangement of the subject matter. The title of the book does not present a true idea of the contents, for the portion devoted to prospecting is relegated to the last chapter and occupies only 14 pages. In reality the book deals with the first principles, more or less clearly stated, of mineralogy, geology, petrology, ore deposits, precious stones, blowpipe analysis, etc. Covering so wide a field it is only natural that much of the matter should be sketchy and that the want of direct knowledge on the part of the author should occasionally be evidenced. For instance, in the chapter devoted to diamonds the existence of the Premier mine and its record stone is ignored. Then in the paragraph about zircon, the French form 'jargon' of the word 'jargoon' is used, and is applied to the "smoky white varieties," while the most common name 'jacinth' is omitted ; the author also refers to the occurrence of the transparent variety that can be mistaken for a diamond, but omits to say that this variety is obtained by heating the yellow and brown stones. The glossary of terms at the end of the book is a curious conglomeration. It goes to the trouble of informing us that 'iron' is a "metallic element," but does not contain any reference to the word 'pitch.' The adjective 'drusy' is defined in terms of a noun, as "cavities in rocks lined with crystals." 'Electrum' is defined as an "alloy of silver and gold.'. This is correct as far as the coinage of ancient Egypt and Greece is concerned, but now-a-days there is a nickel-brass of the German silver group that goes by this name in commerce, being largely used in the manufacture of drawing instruments. The book is not exactly a reliable guide to the learner.

THE EFFECTS OF ERRORS IN SURVEYING. By Henry Briggs. Cloth, octavo, 180 pages, illustrated. London : Charles Griffin & Co. Price 5s. For sale by *The Mining Magazine*.

During the last year or two, the author, who is head of the mining department of the Heriot-Watt college at Edinburgh, has written several papers on mine surveying that have attracted attention by reason of the careful and accurate nature of the work described, and we are therefore not surprised to find that he has made a special study of the range of possible error. In our issue of April we commented in an appreciative spirit on Ingram's book on Geodetic Surveying, mentioning that one section devoted considerable space to a consideration of the effect of errors. We are equally glad to have Mr. Briggs' treatise dealing in the same clear way with an analysis of errors possible in plane surveying and in mine surveying. The study of this subject from a mathematical point of view has been generally neglected, and even among scientists the theory of probabilities and the theory of errors have been placed on one side as being only fantastic mental exercises of no possible practical application. The average surveyor trusts to luck and good judgment for acceptable results, without having much scientific knowledge as to the range of error or the limits of accuracy. Some of the worst blunders in mine surveying have become notorious historically, and on the other hand if the drifts from each end of an incline between two vertical shafts meet reasonably there is almost an equal amount of advertisement. We need not go into details of the various chapters and headings of this book. The author approaches the subject in a frankly scientific manner, but the mathematics involved is not of an advanced character, and his discussions are well within the range of the engineer who has passed through the ordinary course.

ATTRITION TESTS OF ROAD-MAKING STONES. By E. J. Lovegrove, J. S. Flett, and J. Allen Howe. Cloth, quarto, 80 pages, illustrated. London : The St. Bride's Press. Price 5s. For sale by *The Mining Magazine*.

This book contains a reprint of a series of articles, published in *The Surveyor*, based on experiments in connection with the suitability of various stones for road-making purposes. The first-named author is a civil engineer in charge of roads, Mr. Flett is the petrologist to the Geological Survey, and Mr. Howe is curator of the Jermyn Street museum and an authority on building stones. The information in this book is of great value to metallurgists who study the physics and mechanics of tube-mills. A. W. Allen, in another part of this Magazine, draws attention to the book.

ROCKS AND THEIR ORIGINS. By Grenville A. J. Cole. Cloth, pocket size, 180 pages, with illustrations. London and Cambridge : The Cambridge University Press. Price 1s. For sale by *The Mining Magazine*.

This little book forms one of the series of manuals of science and literature published by the Cambridge University Press. These volumes are not what may be described as 'popular,' but rather as guide books to the well-educated man. They are all written by masters of the particular subjects in hand, and their style is reminiscent of those charming Friday evening lectures at the Royal Institution in Albemarle Street. The volume now under notice is by Professor Grenville Cole, of the Royal College of Science at Dublin, the writer of many essays and books well known to the geologist and mining engineer. The book starts with a history of petrographical studies and then enumerates the usual rock-forming minerals. Subsequent chapters discuss the formation, characteristics, and weathering of the various classes of rocks. The largest attention is given in two chapters to limestones and igneous rocks respectively, and the other three chapters are devoted to sandstone, clays, shales, and slates, and metamorphic rocks. The references to special and general books add greatly to the value of the work.

THE ORIGIN OF EARTHQUAKES. By Charles Davidson. Cloth, pocket size, 150 pages, illustrated. London and Cambridge : The Cambridge University Press. Price 1s. For sale by *The Mining Magazine*.

This is another of the series of books referred to in the preceding paragraph. The author is one of the two best known English seismologists and has written on various occasions of earthquake disturbances that have occurred in Great Britain, notably those in Inverness in 1901, and in Derbyshire in 1903, and also in Japan in 1891. A large part of the book is devoted to these events. Much space is also given to the Assam earthquake in 1897 and to that at San Francisco in 1906.

# COMPANY REPORTS

**Tronoh Mines.**—This is the leading alluvial tin property in Perak, Federated Malay States, if not in the world, and under the superintendence of Harry D. Griffiths emerged two years ago from a period of depression that was caused by bad management. The profits are now larger than during the earlier days from 1902 to 1907. The report for 1911 shows a condition of great present prosperity and hope for the future. At the various workings 461,025 cubic yards of profitable gravel was raised and treated, yielding 3856 tons of tin concentrate, as compared with 2945 tons in 1910, and 2158 tons in 1909. About two-fifths of the output came from underground operations and three-fifths from open-cuts. In connection with much of the latter work, it is necessary to remove large amounts of unproductive overburden, the figures for 1911 being 765,888 cubic yards, and the increasing amount that has to be removed has naturally affected the cost of operations. The yield was 18 lb. per cubic yard, which is a slight increase. The income from the sale of produce was £437,094, and other receipts brought the total revenue to £446,377. The net profit was £185,548 as compared with £72,927 for 1910, and £38,774 in 1909. The dividends absorbed £136,000, being at the rate of 85%, and £23,941 was written off the property account against capital expended during the year. The price obtained for the tin concentrate was £21 higher than in 1910. It will be seen therefore that in all three points, total production, yield per cubic yard, and price obtained per ton, there was an increase during the year. It will be remembered that during last summer and autumn there were erratic returns from the mine, owing at first to the deputy manager, during Mr. Griffiths' absence in this country, working a rich patch, and subsequently to some of the mines being flooded. On Mr. Griffiths' return extra pumps were installed, to cope with possible future floods. He is also formulating a scheme for bringing in a cheap water-supply by which to treat large areas of land by hydraulicking. It is interesting to note that during the past year F. Douglas Osborne has been elected to the board.

*THE OPEN-CUT WORKINGS OF THE TRONOH.*

**Ouro Preto Gold Mines of Brazil.**—This company was formed in 1884 to acquire the Passagem mine, Minas Geraes, Brazil. John Taylor & Sons are the managers, and A. J. Bensusan is superintendent. The lode lies flat and has hitherto been developed from three inclines that commence close together at the surface and spread out as they go down. The report now issued covers the half-year ended December 31. Until now the financial year has ended on June 30, but it was decided last year to alter the date to December 31, so that the present report deals with only six months work. During this period, 32,435 tons of ore was mined, and the total recovery by concentration and cyaniding was 11,520 oz., being 7 dwt. or 30s. per ton. As compared with the corresponding 6 months of 1910, there was a fall of 4716 tons of ore and 958 oz. gold. This is due to the great scarcity of native labour, so many of the men being attracted by the new railway work and by the iron ore mines. Under the circumstances it is not surprising to find that the working cost has increased 2s. per ton, standing now at 26s. 9½d. Arrangements have been made for the immigration of workmen from Spain. The manager reports that since the close of 1911, the labour supply has once more become normal. The sale of gold brought an income of £48,755, and other receipts raised the total to £49,726. The cost in Brazil and England was £44,650, while £3132 was written off for depreciation. The preference shareholders received £1831 as dividend, and the ordinary shareholders nothing. It has not been possible to do as much development as was desirable, and the reserves stood at 152,717 tons on December 31, as compared with 170,834 tons on June 30. Water as well as scarcity of labour has hindered development. The ore exposed during the year has, however, been of a promising nature. The new vertical shaft to cut the lode at depth has only been sunk to 85 ft., for water then in-

terfered with operations, and an adit is being driven to drain the workings. The reopening of the Santa Anna mine is being done by the Brazilian Mining Syndicate which has the property under option. The lode is found to be auriferous throughout, but no rich oreshoots have yet been found. Some of the stamps are at work and a small output of gold is being made.

**Balaghat.**—This mine belongs to the Kolar group of gold mines in Mysore State, India, managed by John Taylor & Sons, being the most northerly of the five present producers. The property has been much less successful than those at the southern end. Operations were started in 1886, and the company had to be reconstructed three times before a period of profits was reached. From 1900 to 1907 dividends were distributed, but since then the grade and extent of the orebodies have fallen away. The report for 1911 shows that the mine has continued to yield an output of much the same character as during the previous year. The amount of ore raised and treated was 42,023 short tons, and in addition 96,252 tons of tailing was cyanided. The total income from the sale of gold was £65,048. For 1910 the corresponding figures were 41536, 79,425, and £66,462 respectively. The working cost was £61,300 and royalty £3220, and £4086 was written off for depreciation. There were other small items in the profit and loss account, and the final adverse balance was £1368. During the year, 5335 ft. of development work was done as compared with 4829 ft. in 1910. H. M. A. Cooke, the superintendent, and R. H. P. Bullen, superintendent of the Ooregum, who made an inspection, report hopefully of the recent results in the deepest level at 3175 ft., where a narrow rich vein has been followed for some distance. A similar vein has also been traced from the 1250-ft. to the 1850-ft. level, and it contains sufficient ore to keep the mill going until the ore in the deeper levels is more fully developed. On December 31 the reserve of ore was figured at 25,879 tons, and of sand and slime 57,680 tons. There was also 208,000 tons of tailing, most of which can be re-treated at a small profit.

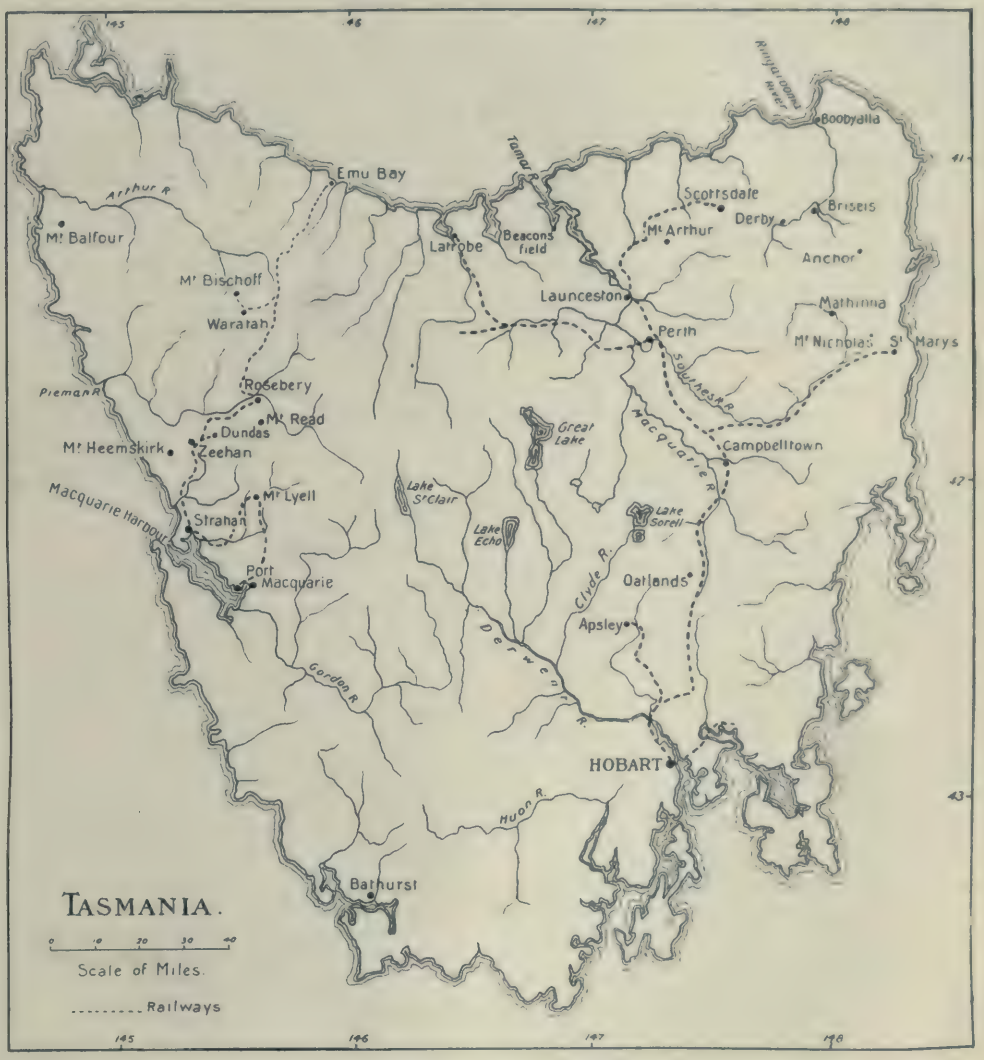
**Esperanza Copper & Sulphur.**—This company was formed in 1906 to acquire the Esperanza group of pyrite mines in the province of Huelva, Spain. Shipments commenced in 1906 and have gradually increased. During the year 1911, the output of ore was as follows: From the Angostura mine 48,494 tons as compared with 47,844 tons in 1910; Esperanza and Forzosa mines 58,988 tons as compared with 64,245 tons in 1910; Nueva Esperanza 1168 tons. Developments have continued to disclose large bodies of ore and the reserves amount to 5 years supply. The shipments from Huelva during the year were 105,809 tons, an increase of 1937 tons over 1910. A comparatively small amount of ore is washed on the spot for copper, and the quantity of precipitate produced in 1911 was 121 tons. The working profit for 1911 was £33,383, out of which £3820 was paid as debenture interest, £7882 allocated to the redemption of debentures, £9000 written off the underwriting commission account, and £10,500 paid as dividend, being at the rate of 3%. T. D. Lawther is manager.

**Spassky Copper.**—This company was formed in 1904 to acquire the Yuspenssky copper mine in the Akmolinsk district of Siberia, together with a smelter at Spassky and the Karagandy coal mines. The mine had been worked by local owners on a small scale. The deposit is a notable example of secondary enrichment and the ore consists largely of chalcocite and bornite. The original reports were made by Pellew-Harvey & Fell, and by Edward T. McCarthy. H. C. Woolmer is now the manager. The report for the year ended September 30 last shows that 31,302 tons of 15% ore was raised and smelted, yielding 2858 tons of copper, as compared with 12,581 tons of 19% ore and 2384 tons of copper during the previous twelve months. The income from the sale of the metal was £219,787, or £76. 18s. per ton in Russia. The cost of production was £37. 14s. per ton. The profit from the copper and coal mining operations, after the payment of interest on debentures, £9031, was £87,911. Out of this £6065 has been paid as directors' percentage of profits, manager's commission, and bonus for the staff, and £77,000 was distributed as dividend, being at the rate of 17½% for the year. As already recorded in our columns, additional capital was created for the purpose of buying a controlling interest in the Atbasar copper property. The reserve of ore at the Yuspenssky mine is difficult to estimate, but a provisional figure is given at 100,000 tons averaging 17½%. The main shaft is being sunk to the 560-ft. level.

**Mount Lyell.**—The report of the premier copper mine in Tasmania for the half-year ended March 31 reflects the results of the recent strike in a greatly diminished output of ore and metal. The figures were as follow: Ore from Mount Lyell mine 39,583 tons, from North Mount Lyell 24,068 tons, total 63,651 tons, averaging 2·73% copper, 1·69 oz. silver, and 0·54 dwt. gold per ton; this compares with 100,957 tons from the Mount Lyell and 59,738 tons from the North Lyell during the previous six months. The output of blister copper was 1500 tons containing 1482 tons copper, 102,454 oz. silver, and 1858 oz. gold; during the previous half-year the output was 3841 tons blister copper. After allowing £11,082 for depreciation, £3972 for prospecting and development work, and £7317 for the cost of the strike, a profit was left of £20,523, as compared with £69,033 the previous half-year. A dividend of £75,003 has been paid; a large proportion of this comes from last year's profit which was not distributed at the time. Owing to the practical cessation of exploration work, no new estimate of ore reserve is now given. The directors have decided to substitute hydro-electric power for the present steam plant, and are taking steps to utilize the water of Lake Margaret, situated 7 miles away, for the purpose of generating current.

**Briseis Tin.**—This company was formed in 1899 to acquire a tin-gravel property in the Ringarooma district in the northeast of Tasmania. Shortly after, a share was acquired in the adjoining New Brothers Home No. 1 property, the company working it for 58% of the net produce. In 1909, as both properties were nearing their end, other tin properties adjoining and gold-gravel properties in Victoria were acquired, and the name of the company was changed to the Briseis Tin & General Mining Co. The No. 1 mine has since been exhausted. The report for the year 1911 shows that at the Briseis mine, 351,000 cu. yd. of drift and overburden was sluiced, and 573 tons of tin concentrate obtained, selling for £78,736. During the previous year, 449,000 cu. yd. was sluiced, yielding 683 tons of concentrate, selling for £77,982. The average price of metallic tin this year was £189, and for 1910 £161, so that in spite of a diminished output the receipts were much the same. The cost in Tasmania was £32,314. At the Briseis mine it is estimated that the reserve gravel is sufficient for 12 months work from January last and that the recovery will be about 250 tons of black tin. At the Krushka Flat property there is 1,000,000 cu. yd. remaining for treatment, estimated to contain 1000 tons of black tin. The development of the Ringarooma property is proceeding, and

large amounts of overburden are being stripped preparatory to the commencement of sluicing. As regards the Wallace gold-gravel property in Victoria, a fourth dredge has been completed, and during 1911 the value of the yield was £21,654; of this £1954 went as C. D. Wallace's share, and the cost was £14,879, leaving a profit of £4821. The amount of alluvium handled was 1,330,650 cu. yd., so that the yield averaged 3·9 pence per yard. The profit and loss account contains other expenses, such as the maintenance of




the London and Melbourne office £3752, depreciation £8627, and taxes £4684. The dividend distributed absorbed £30,000, being at the rate of 5%. Lake & Currie are the consulting engineers, and Lindesay C. Clark is manager. To the report is attached drawings showing the extent and nature of the properties.

**Zeehan-Montana.**—This mine was floated in 1892 as a subsidiary of the Mount Zeehan (Tasmania) Silver Lead Mines Co., and for many years did well. In 1908 the reserve was exhausted and the end seemed near, but the persistence of the manager, John Craze, who was supported in his views by the Government geologists, has been rewarded by the discovery of other orebodies, which are however of less value than those previously worked. In 1910 a dividend was paid once more, and 1911 has been similarly successful. The report for 1911 shows that 1052 tons of marketable ore was raised, and also 11,188 tons of second-class ore that yielded 1167 tons of concentrate. The total sales were 2307 tons, most of which was shipped to Antwerp, owing to the local Tasmanian Smelting Company's plant being closed for part of the time. The average assay of the ore sold was 63% lead and 82 oz. silver. The income from the sale of ore was £39,071 and the profit was £3072. To this was added £3726 brought forward from the previous year, and dividends were paid absorbing £4000, being at the rate of 5%. Mr. Craze reports that the mine is continuing to disclose profitable ore, in much the same way as during the last two years.

**Frontino & Bolivia.**—This company was originally formed in 1864 to work the Silencio and other gold mines in Colombia, South America. It was reconstructed in 1886 and in July 1911, at which latter date additional capital was raised at the recommendation of Pellew-Harvey & Co. for the purpose of remodelling the methods of work. An interim half-yearly report has now been issued covering the six months to December 20 last. During this time 17,147 tons of ore was raised from the Silencio, Salada, and Donagan's mines, and the yield was 6296 oz. or 7·35 dwt. per ton. The revenue was £27,909 and the working cost £32,428, leaving a loss of £4518. The sum of £12,787 was spent on capital account chiefly on new plant. It will be remembered that during earlier years the policy had been to work only high grade ore and to do it regardless of expense. The supply of such ore is now limited and a more systematic method of management is necessary. Unfortunately the development done during the half-year under review was discouraging, though since then the reports have been more hopeful. Work has been actively conducted in connection with improving the shafts, and putting the plant in order. The ore reserve on December 20 was estimated as follows: At Silencio 8769 tons averaging 18 dwt., Salada 9534 tons averaging 8 dwt., and Donagan's 5863 tons averaging 4½ dwt. It is hoped to have the reorganization at the mine and mill completed by the late autumn.

**Waihi Grand Junction.**—This company was formed in 1895 to acquire property adjacent to the Waihi gold mine, New Zealand. Three of the lodes found in the Waihi mine continue into the Grand Junction territory, namely, the Martha, Royal, and Empire. For many years the results of development work were disappointing, and much capital was spent to no purpose. In 1909 F. C. Brown, the manager (the inventor of the agitator now known as the Pachuca vat), resigned and he was succeeded by W. F. Grace, who has effected a radical change and made the mine profitable. The report for 1911 shows that 105,956 short tons of ore was treated, yielding gold-silver bullion to the value of £152,394. The working expenses, including £21,191 charged to development redemption, amounted to £107,439, and after £14,636 had been written off for depreciation, the profit amounted to £25,949. Out of this, £19,218 was distributed as dividend, being at the rate of 5%, the same as the year previous. The cost includes several items for renewal and extension of plant, and further expenditure for this purpose will have to come out of the current year's income. The grade of ore per ton has fallen 3s. 2d. during the year, and the mine cost is 3d. per ton higher. Developments have been pushed actively so as to provide a steady supply of ore to the enlarged plant at a rate of 500 tons per day. The reserve was increased by 65,450 tons during the year and stood at 198,350 tons on December 31. Since the turn of the year the yield per ton in the mill has increased.

**Golden Horse-Shoe.**—A year ago the controversy was acute with regard to the ore reserves at this Kalgoorlie gold mine, and in our issue of June last year we gave details of the position. The report for the year 1911 now published shows that 269,667 long tons of ore was sent to the mill, where 24,518 oz. gold was recovered by amalgamation; 88,536 tons of sand was cyanided yielding 5702 oz.; 159,951 tons of slime yielded 35,280 oz.; 21,180 tons of concentrate was roasted and subsequently yielded 25,471 oz. by cyanide treatment. Re-treated residues and cyanide slags yielded 3800 oz. The total income from the sale of gold was £403,428. The cost of mining was £146,838, of extraction £140,164, development £49,916, and London and administration expenses £17,295. The debenture interest absorbed £6000, and the profit was £30,458. Out of this £25,500 has been written off for depreciation of plant, and the £1,500,000 ordinary shares receive no dividend. It will be noted that the lack of divisible profit is due to the charging of the whole of the development cost against revenue and to the large allowance for depreciation. From 1899 to 1909 the average dividend was £250,000 per year, and in 1910 the fall to £75,000 was considered an exceptional episode. The ore reserve on December 31 last was 804,269 tons averaging 8·8 dwt.; as compared with last year, the total is maintained, but the average content has fallen 0·7 dwt. J. W. Sutherland, the manager, writes hopefully of the future.

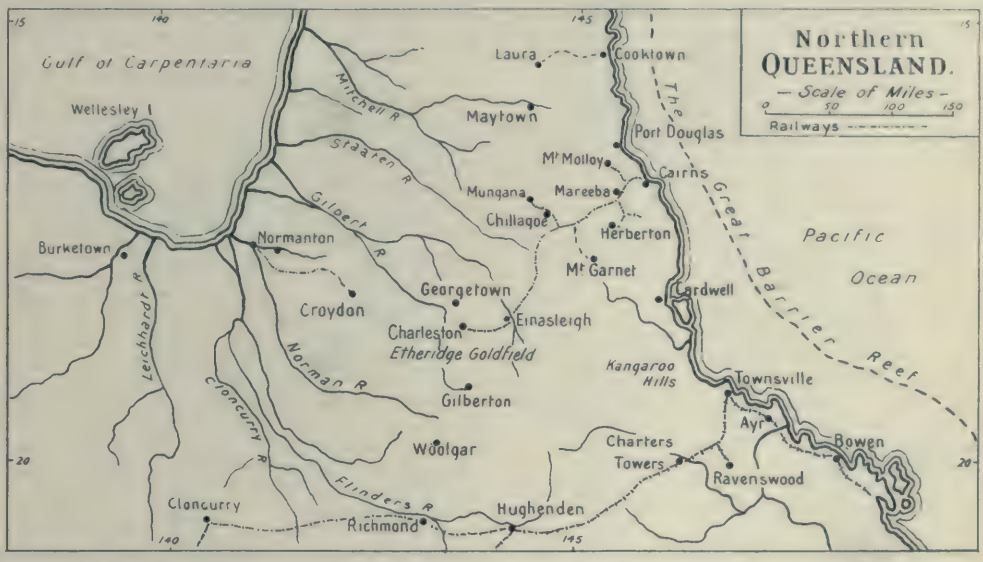
**Etheridge Gold.**—This company was formed in Melbourne in December 1910, to acquire from the Chillagoe company a group of gold-mining properties at Charleston, in the Etheridge goldfield, North Queensland. The first annual report covering the period ended January 31 last shows that development has been actively continued at the Havelock and Nil Desperandum properties with gratifying results. The reserve at the former is estimated at 16,060 tons averaging 16 dwt. per ton, and at the latter 9240 tons averaging 14 dwt. Developments at the Queenslander and Big Reef mines are in abeyance at present and the reserves remain respectively at 16,700 tons and 8350 tons both averaging 16 dwt. The ores are variable and complex, and are to be concentrated first and cyanided after. Wilfley tables and Minerals Separation flotation plant have been erected. The Havelock ore contains copper, and the Queenslander lead and zinc. It is expected that the mill will start in the early summer. A. J. Macgeorge is the manager.

**Geduld.**—This company owns a large property in the far east Rand, where the dip is flat, and it belongs to the Goerz group. W. M. Cameron is consulting engineer, and L. A. Womble is manager. Two shafts have been sunk, out of six contemplated. No 2 cut the Main Reef at 1694 ft., and No. 3 shaft at 1839 ft., this work having been done in 1905 and 1906. Development has been centred on the ground in the vicinity of No. 2 shaft. Milling was started in 1908 with 50 stamps and two tube-mills, but was suspended shortly afterward on account of the flooding of the workings. After a year's delay, operations were recommenced in February 1910. During the year 1911, the report of which is now published, 160,638 tons of ore was raised, and after the removal of 17½% waste, 138,700 tons averaging 6·9 dwt. was sent to the mill. By amalgamation 10,299 oz. was recovered below the stamps and 9997 oz. below the tube-mills; in the cyanide plant 23,517 oz. was recovered, making a total yield of 43,813 oz., or 6·3 dwt. per ton milled. The income from the sale of gold was £185,780, or 26s. 9d. per ton milled. The working cost was £119,495, or 17s. 2d. per ton, and £31,243 was charged to development redemption, equal to 4s. 6d. per ton. The working profit was £35,040, or 5s. per ton, which, added to the balance brought forward from 1910 and other items of income, made a balance to the credit of profit and loss of £62,650. Out of this, £40,000 has been written off for mine development, and the balance carried forward. The mine development account now stands at £131,665. The ore reserve on December 31 last was estimated at 607,300 tons, averaging 8·18 dwt. over 44 inches, together with 190,500 tons of indicated ore, averaging 9 dwt. over 42 inches. Later news is given in our 'Review of Mining.'

**Apex.**—This company was formed in 1893 to acquire property in the far east Rand, containing both gold and coal. It belongs to the Anglo-French group and the mines adjoin the Kleinfontein and Benoni, which are in the same control. The colliery has been producing since 1896, but the gold deposits are still in the period of development. The present position of the company is of special interest, because, as recorded last month, the Benoni having come to the end of its capital is to be amalgamated with the Apex. The report for the year 1911 shows that at the coal mine 219,410 tons of marketable coal was raised, as compared with 237,240 tons the year before. The fall is due to the scarcity of orders, a fact which is particularly to be regretted seeing that the plant has been extended to handle 40,000 tons per month. The profit was £44,189, out of which £14,326 was spent on capital account, £2790 paid as tax, and £30,000 was distributed as dividend. In the gold mine, development work was hindered by water difficulties, but the completion of the pumping plant subsequently removed this trouble. The deposit is being developed by a shaft that cuts the reef at 1741 ft., and thereafter an incline shaft has been sunk. A second vertical shaft is being sunk to meet the deposit on the dip, but the work is temporarily suspended while the upper portions are developed. During 1911, 15,721 ft. of development work was done, and on December 31, the reserve was calculated at 258,060 tons averaging 6·5 dwt. The amount of capital expenditure during the year was £166,482, and the company still has £100,000 in hand. Some of the latter will be available for reorganizing the Benoni metallurgical plant when the proposed amalgamation takes place.

**Nigel Gold.**—This mine is in the Heidelberg district of the Transvaal on the southerly continuation of the Witwatersrand Series, and is situated about 16 miles due south of the mines in the far east Rand. It is owned by a Natal company, and has been operated profitably since 1888. In the middle of 1910 the number of stamps was increased from 55 to 75, but owing to irregular labour supply it has been impossible to keep the whole of the plant in continuous operation. The report for the year 1911 shows that an average of 65 stamps was employed, together with one tube-mill. The amount of ore milled was 134,450 tons averaging 7·7 dwt., and the total extraction by amalgamation and cyaniding was 46,299 oz. or 6·88 dwt. per ton. In addition 16,024 tons of accumulated slime was treated yielding 3779 oz. gold. The income was £213,707, and the profit £48,268. Out of this, £33,465 was distributed as dividend, being at the rate of 15%; £12,000 was allocated to the redemption of extraordinary capital expenditure; and £1700 was spent on diamond-drilling. The development done during the year has given moderately good results, but the content of the ore disclosed has been rather lower. The reserve on December 31 stood at 190,572 tons averaging over 6 dwt., and 567,066 tons below 6 dwt.

**City & Suburban.**—This company was registered in Natal in 1887 to acquire a mine on the Rand outcrop, and milling commenced in 1891. It is affiliated to the Central Mining group, and Charles Glyn is manager. The report for 1911 shows that 372,763 tons of ore was raised, and after the removal of 15% waste, 316,679 tons averaging 7·88 dwt. was sent to the mill. The recovery by amalgamation was 72,707 oz., and by cyanide 40,599 oz., a total of 113,306 oz., or 7·13 dwt. per ton milled. The revenue from the sale of gold was £474,299, or 29s. 10d. per ton, and the working cost was £311,776, or 19s. 7d. per ton, leaving a profit of £162,523, or 10s. 3d. per ton. The treatment of accumulated slime brought an additional profit of £9663. The dividend absorbed £153,000, being at the rate of 9s. per £4 share. The profits were markedly greater than during the previous year, owing to the higher grade of the ore mined; for 1910 the distribution was £68,000. On December 31, the ore reserve was calculated at 789,084 tons averaging 7·6 dwt. There is also a large amount of ore available from the old workings and 132,238 tons was drawn from this source during 1911. Toward the end of the year 2 tube-mills and a Caldecott filter-table were installed.




**Worcester Exploration & Gold.**—This company was formed in 1887 under the laws of Cape Colony for the purpose of working a small property on the Rand outcrop situated between the Robinson and Ferreira mines. This property, after being worked at a handsome profit on the small capital for 11 years, was

sold in 1903 for £90,000 cash to the Ferreira. The directors at the same time acquired the Kentish and Bonnie Dundee claims to the north of Barberton, and in 1904 the developments were so encouraging as to warrant the erection of 40 stamps and a cyanide plant. A tube-mill was added in 1909. The report for 1911 shows that 60,280 tons of ore was raised and sent to the mill, where 10,880 oz. gold was recovered by amalgamation and 5594 oz. by cyanide, making a total of 16,474 oz. worth £69,736. This was an extraction of 23s. 1d. per ton. The working cost was £45,026 or 14s. 11d. per ton, leaving a working profit of £24,708 or 8s. 2d. per ton. Out of this, £8134 was allowed for depreciation, £350 paid as directors' fees, and £1610 as profits tax. The dividend absorbed £19,144, being at the rate of 20%. The ore reserve on December 31 stood at 93,000 tons, a fall of 27,000 tons during the year, due to the scarcity of native labour.

**New Heriot.**—This mine is in the same control as the City & Suburban, mentioned in the preceding paragraph. The property is a small one on the outcrop in the central Rand. Milling commenced in 1888, and the plant has gradually been extended until it now contains 70 stamps and 2 tube-mills. The capital is £115,000, and since 1895 the dividends have been steadily maintained. The report for 1911 shows that, during the year, 179,618 tons of ore was raised, and after the removal of 19% waste, 144,431 tons averaging 8·6 dwt. was sent to the mill. The recovery was 42,397 oz. by amalgamation and 18,282 oz. by cyanide, making a total of 60,679 oz., or 8·39 dwt. per ton. The revenue was £249,926, or 34s, 6d. per ton milled, and the working cost was £147,756, or 20s. 5d. per ton. The profit was £102,170 or 14s. 1d. per ton. In addition 26,058 tons of accumulated tailing yielded gold worth £13,587 at a cost of £2959. The dividend absorbed £92,000, being at the rate of 80%. The sum of £10,313 was spent on capital account in connection with new electrical plant, etc. The ore reserve at December 31 was estimated at 569,716 tons averaging 8·4 dwt., a substantial increase during the year.

**Geldenhuis Deep.**—This company belongs to the Rand Mines group, and was formed in 1909 as an amalgamation of Geldenhuis Estate, Geldenhuis Deep, and Jumpers Deep. The Geldenhuis Estate commenced work on the outcrop in 1887 and was practically exhausted at the time of consolidation, nothing but pillars being left. The Geldenhuis Deep commenced operations in 1895, and the Jumpers Deep in 1898. The total number of stamps is 420 and there are also 7 tube-mills. B. Madew is consulting engineer, and H. Musson Thomas is manager. The feature of the year 1911, as disclosed in the present yearly report, was the unsatisfactory result of development. The amount of 'ore' exposed was 1,448,614 tons, but only 652,663 tons, averaging 6·7 dwt., was classed as profitable. About the middle of the year it was decided to increase the amount of development, and during the second half of the year the average footage was over 3000 ft. per month as compared with 1700 ft. per month during the earlier part of the year. It was not possible to make this increase without interfering with stoping, owing to the irregular supply of natives, and in consequence the amount of ore milled showed a slight decrease. The ore raised totalled 1,013,323 tons, and after the removal of 21% waste, 801,860 tons averaging 6·9 dwt. was treated in the mill, as compared with 826,610 tons in 1910. The recovery by amalgamation was 175,318 oz. and by cyanide 89,765 oz., making a total of 265,083 oz. or 6·6 dwt. per ton milled. The revenue from the sale of gold was £1,111,423 or 27s. 9d. per ton milled, and the working cost £883,845 or 22s. 1d. per ton, leaving a working profit of £227,577 or 5s. 8d. per ton. In addition £93,027 was spent out of revenue on electrification of plant, winding engines, etc., and £18,121 was paid as profits tax. The dividends absorbed £175,725, being at the rate of 30%; of this about half was paid out of the balance brought forward from 1910. The ore reserve on December 31 was estimated at 2,262,840 tons averaging 6·2 dwt. per ton, as compared with 2,521,481 tons averaging 6·1 dwt. the year before.

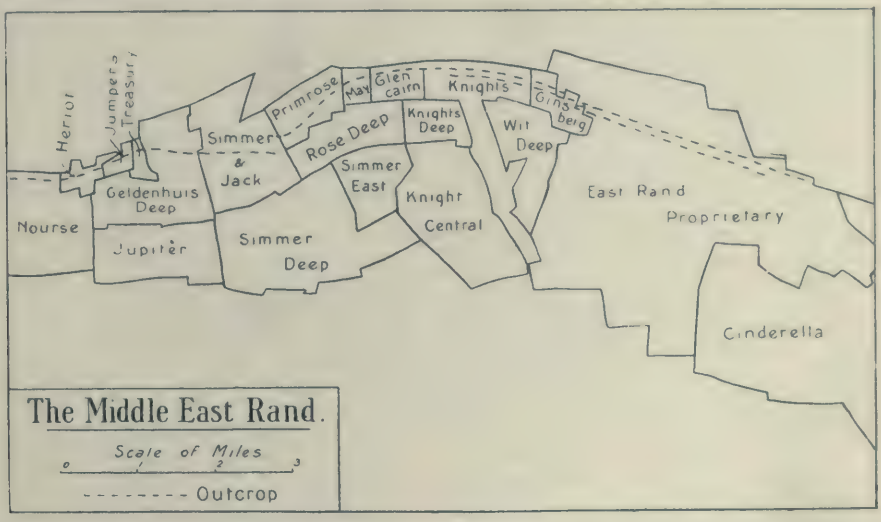
**Jupiter.**—This company owns 'second deeps' on the dip below the Geldenhuis Deep in the central Rand. It belongs to the Consolidated Gold Fields group and has a reduction plant in partnership with the Simmer Deep, situated farther east on the dip of the Simmer & Jack. The report for 1911 shows that the 100 stamps and 6 tube-mills of the joint plant used for the output of the Jupiter have not been fully employed owing to the short supply of native labour. The ore mined totalled 323,541 tons, and after the removal of waste, 314,650 tons was sent to the mill. By amalgamation 47,613 oz. was recovered, and by cyanide 38,069 oz., making a total of 85,682 oz. The revenue from the sale of gold was £359,171, or 22s. 9d. per ton milled, and the working cost was £332,232, or 21s. 1d. per ton, leaving a working profit of £26,938, or 1s. 8d. per ton. No dividend is being paid, and the only dividend yet distributed was 5% for 1909. C. D. Leslie, the consulting engineer, reports that the ore reserve on December 31 consisted of 1,089,000 milling tons averaging 5¾ dwt., and that in addition 245,000 tons of partly developed ore showed an estimated content of 5·2 dwt. per ton. It is also reported that a further 230,000 tons has been proved with a content of 4 to 4½ dwt. per ton, but this cannot be worked to advantage at the present level of costs.

**Simmer Deep.**—As recorded in the above paragraph, this company belongs to the Consolidated Gold Fields group, and operates 200 stamps and 9 tube-mills of the joint plant of the Jupiter-Simmer Deep. Milling started in 1908. The report for the year 1911, now published, shows that the mine is working at much less than the mill capacity, only 125 of the 200 stamps being employed. The amount of ore raised was 585,503 tons, and after the removal of 7⅞% waste, 539,981 tons was sent to the mill. The yield by amalgamation was 72,757 oz., and by cyanide 48,360 oz., making a total of 121,117 oz., valued at £507,654, or 18s. 9d. per ton milled. The working cost was £450,870 or 16s. 8d. per ton, leaving a profit of £56,784 or 2s. 1d. per ton. The development during the year amounted to 16,219 ft., and on December 31 the reserve was estimated at 1,312,000 tons averaging 4·9 dwt. per ton, together with 263,000 tons of partly developed ore averaging 4·8 dwt. C. D. Leslie, the superintending engineer, and H. S. Macgregor, the manager, give no hopeful view as to the immediate future of this mine.

**New Primrose.**—This mine belongs to the Barnato group and is situated on the outcrop in the middle east Rand. Milling commenced in 1889, and since 1895 the crushing plant has consisted of 160 stamps. The report for 1911 shows that the favourable position recorded a year ago has been more than maintained. During the year, 322,311 tons of ore was raised, and after the removal of 16% waste, 281,648 tons averaging 7·3 dwt. per ton was sent to the mill. The yield by amalgamation was 61,356 oz., and by cyanide 33,351 oz., making a total of 94,707 oz. In addition 40,705 tons of accumulated slime was treated, and yielded 5689 oz. gold. The revenue from the sale of gold was £421,280, and the working profit was £217,658. The sum of £227,500 was distributed as dividend, being at

the rate of 70%. The ore reserve on December 31 was calculated at 423,311 milling tons, estimated to yield 6·7 dwt. per ton. The mine is worked on single shift. J. L. van Eyssen succeeded R. Clarkson as manager last July.

**Witwatersrand Gold.**—This company owns the outcrop mine commonly known as Knight's in the middle east Rand. Milling started in 1888, but was suspended from 1891 to 1896, during which time attention was centred on exploration and development. Dividends have been paid with regularity since 1905. The control is with the Barnato group; J. G. Lawn is consulting engineer, and F. B. Lewis is manager. During the year 1911, 585,132 tons of ore was raised, and after the removal of 24% waste, 416,741 tons was sent to the mill. The recovery by amalgamation was 62,086 oz., and by cyanide 42,592 oz., or a total of 104,678. The estimated content of the ore milled was 5·45 dwt. per ton, and the extraction was just under 5 dwt. The revenue from the sale of gold was £445,110, or 21s. 2d. per ton milled, and the working cost was £293,811, or 14s. per ton, leaving a profit of £151.299, or 7s. 2d. per ton. The dividend absorbed £148,750, being at the rate of 35%. The sum of £96,042 was spent, out of undistributed profit earned during 1910, upon shaft-sinking and equipment. The new vertical shaft in the southern part of the property is down 944 ft., and the northern incline shaft was sunk 744 ft. during the year to the 13th level, corresponding to the 1st level in the southern section. The results at this level are gratifying. The ore reserve on December 31 was estimated at 1,225,084 tons averaging 5·65 dwt. A more vigorous removal of waste is now being practiced, and toward the end of the year as much as 29% was being rejected.




**Knight Central.**—This mine is a deep level in the east central part of the Rand and adjoins the outlying portion of the property of the Witwatersrand Gold Mining Co. commonly known as 'Knight's,' particulars of which are given in the preceding paragraph. The control is with the Neumann group. A plant consisting of 120 stamps and 3 tube-mills was started early in 1909. The property is being developed through two vertical shafts which cut the Main Reef series at 1958 ft. and 2245 ft. respectively. A year ago we recorded that the development was not giving as good results as expected, and that in consequence the contemplated extension of the metallurgical plant has been postponed. The report for 1911 now published shows that the same conditions continue. The profitable ore exposed in development is small as compared with the amount of driving and sinking done. The reserve on December 31 last was 644,300 tons averaging 6 dwt., a fall of 55,700 tons during the year. For 1911 the average recovery was 6d. per ton higher than in 1910, but the working cost was 1s. 3d. more, due to the greater amount paid for labour. During 1911, 350,353 tons of ore was raised and, after the removal of waste, 315,191 tons averaging 5·81 dwt. was sent to the mill. The extraction by amalgamation was 62,466 oz., and by cyanide 25,125 oz., the total being 87,591 oz., or 5·55 dwt. per ton milled. The revenue from the sale of gold was £366,406, or 23s. 3d. per ton milled, and the working cost was £295,588, or 18s. 9d. per ton, leaving a profit of £70,817 or 4s. 6d. per ton. Out of the profits £32,412 has been spent on capital account, chiefly for plant and shaft-sinking. No dividend has been distributed, as it is desirable to push forward the development.

**Glencairn.**—This company belongs to the Barnato group, and was formed in 1889 to acquire property on the outcrop in the middle east Rand. Milling started in 1890 and dividends were first paid in 1894. After the war, dividends were not resumed until 1906, and the rate of distribution has been comparatively small. The grade of the ore is lower than that of any other worked at a profit on the Rand. During 1911, 248,815 tons of ore was raised and, after the removal of 15% waste, 227,753 tons was sent to the mill. By amalgamation, 25,115 oz. was recovered, and by cyanide 14,377 oz., making a total of 39,492 oz. The content of the ore milled was 3·92 dwt. per ton, and the recovery 3·47 dwt. In addition, 22,566 tons of accumulated slime yielded 3123 oz. gold. The revenue from the sale of gold was £181,193 and the working cost £153,708, leaving a profit of £27,485. The sum of £27,500 was distributed as dividend, being at the rate of 5%. On December 31 the ore reserve was estimated at 925,000 milling tons, from which 3½ dwt. could be recovered per ton. The company also has 350,000 tons of accumulated slime containing 1·9 dwt. per ton.

**Ginsberg.**—This company belongs to the Barnato group and is situated on the outcrop immediately to the west of the East Rand Proprietary. Milling commenced in 1894, and dividends were paid from 1897 to

1905 except during the war. For two years after 1905 no profit was made and in 1906 the company was amalgamated with its neighbour the Balmoral. Dividends were resumed in 1908. The report for 1911 now published shows that the general position is highly satisfactory in spite of labour shortage. More machine-drills have been used, though they are inconvenient in this mine with its steep dip. The amount of ore raised was 200,068 tons, and after the removal of 30% waste, 138,459 tons averaging 7¼ dwt. was sent to the mill. The total yield by amalgamation, concentration, and cyaniding was 47,407 oz. or 6·85 dwt. per ton milled, valued at £201,291. The working cost was £144,390 and the profit £56,901. The dividend absorbed £52,500 being at the rate of 25%. The Ginsberg section of the property was closed for 5 months, while the shaft was re-timbered. The reserve on December 31 was estimated at 367,646 milling tons that is expected to yield 6·8 dwt. per ton. A tube-mill has been added during the year as a supplement to the 80 stamps but it did not start work until 1912.

**Witwatersrand Deep.**—This mine is on the dip in the middle east Rand, below the Ginsberg and Knight's. The control is with the Neumann group: S. C. Thomson is consulting engineer; and E. E. Hardach is manager. Milling started in 1902, and the first dividend was paid in 1906. A new plant was erected in 1904, containing 245 stamps and 4 tube-mills. During the year 1911, 564,188 tons of ore was mined, and after the removal of 11½% waste, 500,330 tons, averaging 7⅛ dwt. per ton, was sent to the mill. The recovery by amalgamation was 124,446 oz., and by cyanide 50,813 oz., making a total of 175,259 oz., or 7 dwt. per ton. The revenue from the sale of gold was £732,843, and the working cost was £431,301, leaving a profit of £301,542. The dividend absorbed £192,500, being at the rate of 35%. A larger sum could have been distributed and thus the customary dividend maintained, but owing to water difficulties it was considered best to strengthen the company's resources. The so-called 'water dike' gives much trouble to this mine and to Knights Deep, and unusually large pumping stations are required underground. During the past year, the inrush of water at the 16th level was so great as to flood the pumps at the 18th level. The amount of development was in consequence restricted. The water also causes inconvenience in prospecting and developing the faulted portion. The upthrow at this point causes a duplication of the geological series between the 18th and 16th levels. It will be necessary to cross-cut 700 ft. to connect with the faulted part. The ore reserve on December 31 was estimated at 1,436,202 tons averaging 6·8 dwt. per ton.

**Bantjes.**—This mine is situated on the outcrop in the middle west Rand, and has only quite recently arrived at a productive stage. The control is with the Rand Mines group; Percy Cazalet is consulting engineer, and W. W. Lawrie manager. The deposits are being developed from three inclined shafts, the East, Central, and West. The East shaft is down 2379 ft., the Central 2653 ft., and the West 1095 ft. The most important of the 'reefs' at this part of the Rand is the South Reef, which is providing nine-tenths of the ore. On December 31 last the reserve was calculated at 896,087 tons averaging 7·3 dwt. The amount of unprofitable rock developed is 759,025 tons. The reduction plant contains 100 stamps and three tube-mills, and milling started in August 1910. The report for 1911 shows that 278,540 tons was raised from the mine, and this together with 47,936 tons from the dump was sent to the sorting station. After the removal of 16% waste, 273,212 tons averaging 7¼ dwt. was sent to the mill. Only 60 of the stamps were in operation owing to scarcity of underground labour. The yield by amalgamation was 51,734 oz. and by cyaniding 37,301 oz., making a total of 89,035 oz. or 6½ dwt. per ton milled. The revenue was £372,955 or 27s. 4d. per ton milled, and the working cost £319,019 or 23s. 4d. per ton, leaving a working profit of £53,137 or 4s. per ton. Out of the profit, £29,970 was spent on cyanide plant, shaft equipment, air-compressors, etc. The Butters slime-plant was started in July and is giving greatly improved extractions, the residue left in the slime being not greater than 0·12 dwt.

**Durban Roodepoort.**—This gold mine in the middle west Rand is not connected with any of the great houses. It started operations in 1888 with 20 stamps, and the present equipment contains 90 stamps. During the year 1911, 189,944 tons of ore was raised, of which 34% came from the South Reef and 66% from the Main Reef. After the removal of 13% waste, 165,662 tons was sent to the mill. The yield by amalgamation was 34,015 oz. and by cyanide 14,127 oz., making a total of 48,142 oz. The revenue from the sale of gold was £203,881, and the working cost £183,372. In addition, £5565 was paid as profits tax, and £7391 as London expenses, while £3750 was allowed for depreciation. Interest on reserve fund brought in £2241. The dividends absorbed £50,000, being at the rate of 40%. H. Ross Skinner, the consulting engineer, and A. S. Milne, the manager, report that the South Reef is now practically exhausted, and that nothing remains for extraction but the lower-grade Main Reef. Of this they estimate 661,791 tons as payable reserve, calculated to yield 20 to 22 shillings per ton. This will afford work for 4 years, and there is no probability of the life of the mine being extended beyond this. Since the formation of the company, £1,335,083 has been distributed as dividend, being 1085% on the capital.

# TRADE NOTES

*Most of the trade publications mentioned in this column are available for distribution and the manager of The Mining Magazine will be pleased to secure copies for persons interested.*

**The Wolf Safety Lamp Co.** send us interesting details of a new Gas-Mixing Apparatus for Safety Lamps which has proved satisfactory after many practical tests.

**Deister Concentrators** are to be installed at the Geevor tin mine, in the West of Cornwall. One No. 4 sand-table and three No. 3 slime-tables are being erected.

**The McKiernan-Terry Drill Company** have issued two new and instructive bulletins relating to the Wizard Rock-Drill and Heavy-Duty Pile-Hammers. No secret is made of the details of construction, which are fully illustrated and explained.

**The International Engineering and Trading Co.** have shown enterprise in translating into Russian the bulletins and catalogues of the firms they represent. We have in our files a complete set of these catalogues.

**The Traylor Engineering Co.** have sent us four of their catalogues covering Cyaniding Machinery; Furnaces and Smelting Accessories; Concentrating Mills and Machinery; and Stamp-Milling Machinery. The catalogues are all uniform in size, well printed and contain detailed information concerning the special machines of their own manufacture. The 20-stamp mill of the Colorado Co. operating in Masbate, Philippine Islands, was made by this company.

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